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THE ENGINEERING SIDE OF ELECTRO-CHEMISTRY.

The predominance of engineering problems is one of the most striking features of modern electrochemical practice, due without doubt to the extension of investigations from the plane of the laboratory to the scale of commercial production. Electrochemistry is one of the most highly specialized branches of industry at the present time, but it touches many questions of mechanical and electrical design, construction and operation as closely as any department of applied science which can be named. The engineering side of such work is therefore of no little interest to organizations of the central-station type which are called upon from time to time to supply electricity to plants handling important chemical processes, and incidentally to advise the best methods of utilizing energy in connection with research on a large scale or the production of useful commodities.

The safe supply of energy to such plants is a vital matter, since, as pointed out by Mr. J. R. Wilson last week at the meeting of the American Electrochemical Society, the employees often are without electrical knowledge and not seldom are unfamiliar with the English language. Simple and so-called foolproof installations are consequently of the utmost importance, and the guarding of all high-tension wiring and equipment from possible contact is fundamental to safety. It is a good plan to locate all operating devices on the low-tension side of the system where the employees may use them without leaving their places. All dead metal exposed, such as switchboard frames, switch levers, transformer cases, generator and motor frames, and if feasible, one lead of secondary circuits, ought to be thoroughly grounded and arranged to facilitate ready inspection. The establishment of a distributing center from which all low-tension or non-dangerous circuits may be radiated, keeping the high-tension service outside a fixed place, is highly desirable where local conditions permit doing this without too great an investment in the distributing feeders and fittings.

The investigation of electrochemical problems frequently calls for the development of special machinery and appliances. Many forms of electric furnaces, for example, have been built within the last few years, and in many of these the question of terminal design has been a difficult one. The resistance of large electrodes is small in comparison with the ohmic characteristics of line wires, busbars and numerous fittings regularly used in power work, but the large current flow which is required makes even a moderate voltage drop a point of

great consequence in many instances, since even slight increases in resistance cut down the output of the furnace. In the past electrodes have too frequently been prepared from materials greatly lacking in uniformity, and many troubles have followed. The main cause of failure, as pointed out by Mr. R. Turnbull, has been the use of the wrong carbon material. The best electrodes today are made from anthracite coal, and the advent of the molded screw has greatly increased the flexibility of service and reduced the time required to change terminals. The use of moderate-sized electrodes, current densities of from 30 to 35 amperes per square inch of cross-section, and the application of current to the electrode well inside the outer end to save energy losses, are features of the latest and best practice.

Studies of heat-insulating power and the investigation of phenomena in liquids under various conditions call for the establishment of highly specialized apparatus, and while the design of such equipment is primarily a problem for the electrochemical expert, it not seldom involves much co-operative work in connection with the utilization of electrical service.

THE SPACE ECONOMY OF THE ELECTRIC TRUCK.

The increasing pressure of civilization in large cities demands that the closest consideration shall be given to every feasible means of economizing space in the public streets, and even private organizations are figuring the cost of real estate and departmental quarters upon the basis of trying to make every square foot of area tell toward the profits of the concern. The electric truck is coming to be one of the foremost agencies in this important work of space conservation. The real cost of maintaining horse-drawn equipment within a reasonable distance of the business center has been too little appreciated in the past, but the growing use of motor trucks on a large scale is establishing new data of great significance from the real-estate point of view.

Six years ago a prominent manufacturer in New York had 120 horses, a stable with 200 feet of street frontage and a depth of 100 feet, three wagon yards, a blacksmith shop and other horse-delivery equipment, all adjoining his plant on East Fifty-fifth Street, which in these days is well down-town. In 1909 he purchased his second five-ton electric truck and later in the year, six more. In 1911 he was operating 30 electric trucks, and these saved him $25,000 per year, by the testimony of his superintendent. By July, 1912, this concern will be operating 52 electric trucks and no horses whatever, all the latter having been sold by April 15. Half the former stable was torn down in March, and a handsome three-story building erected on the space thus secured, this building being devoted to a bottling plant and shipping room. On the ground formerly devoted to one of the wagon yards, the manufacturer has built an 85-by-100-ft. garage, two stories high, with a capacity of 48 trucks, and two more stories will shortly be added, thus enabling 96 electric trucks to be accommodated.

With real-estate values what they are in large cities, it is not difficult to see how the saving in ground rent added to a substantial saving on each truck over a corresponding horse-delivery system may shortly bring the annual saving close to $50,000. The sale of all the horses and wagons has rendered available the ground formerly devoted to two wagon yards and half the stable, or in this case an area equal to at least 10 city lots on the 20-by-100-foot basis. There is now room to extend the plant at any time or to dispose of the holdings; the later additions to the property are modern in all particulars and the delivery service the most flexible and economical possible on land without the use of railway tracks. While it is true that comparatively few firms can keep 50 five-ton electric trucks busy, many business organizations in large cities must soon seriously consider the question of moving their horse stables farther from the urban center. The objectionable feature of this issue is that cheaper ground rents are secured at a loss of time and energy on account of the large amount of dead mileage involved in daily operation. Further, the cost of feed is the same in the suburbs as in the city, and horses cost more each year. From the standpoint of the manufacturer, therefore, the space economy of the electric truck is a very important argument in its favor, quite apart from the reduction it effects in street and warehouse congestion in localities subjected to the demands of heavy traffic.

MOVING PICTURES AS A CENTRAL-STATION ADVERTISING MEDIUM.

The universal popularity of the moving-picture show has opened up a new field of advertising for central-station companies which is both unique and effective, but prohibitive in cost when attempted individually to all except the larger companies. Moving-picture films depicting the advantages of electrical appliances in the home can be made entertaining and convincing, and are an ideal method of forcibly showing the great contrast between household conditions with the old coal stove and the absence of conveniences and the highly satisfactory results achieved by the use of the electric range, electric table utensils, washing machines and other electrical household devices.

The manufacturers of electrical appliances, appreciating the value of such advertising, both from the standpoint of the central station and for increasing the sale of their own product, have assumed the financial burden of making these films, which they offer to loan to central stations for from three to six days, the central-station management arranging with a local picture theater for exhibition. Thus at practically no cost central stations can avail themselves of a very excellent advertising scheme.

THE TITANIC WRECK AND THE CONTROL OF WIRELESS.

We called attention in these columns last week to the valuable service which was rendered by the wireless telegraph in saving at least a portion of the human cargo which was threatened with death in the sinking of the *Titanic* on April 15. Without the service of the wireless apparatus it is impossible to say whether there would be any survivors at all. Even as it is the death roll is shockingly large, amounting to over two-thirds of the passengers and crew of the illfated vessel. Probably such a loss will never occur again, as the horror of this catastrophe has called forth a sentiment which will undoubtedly compel greater precautions for the saving of life than existed in this case.

Complaints have been raised at this time that the wireless service was not as good as it might have been, and that if the operation of wireless apparatus was at present under government control there would have been less difficulty and interference with the transmission of messages. The story of Mr. Harold Bride, the assistant operator on the *Titanic,* will be found on other pages of this issue, and contains nothing to substantiate the claim that there was any undue interference with the wireless operation.

We called attention in these columns on March 30 to the proposed legislation for controlling wireless operation in this country and to the inadvisability of incorporating into law the provisions of such a bill. The accident to the *Titanic* has focused attention upon this matter, but the actual facts lend no support to the contention of those who are clamoring for legislation. The present bill is favored principally by the Navy Department, and if the power to promulgate regulations were put into the hands of a government official, this power would unquestionably be used in favor of the Navy Department. It would, undoubtedly, work hardships upon the commercial companies and upon individuals in experimental work, whether amateur or professional. Mr. Bride claims that the failure of the Navy boat *Chester* to receive answers to its communications was due to no outside interference. He states that the operators on the *Chester* were unable to handle the messages rapidly and the operators on the *Carpathia* deliberately refused to interchange messages with them for what they considered to be good reasons.

With respect to the subject of wireless regulation, a communication to the Boston *Herald* of Friday, April 19, by John Stone Stone is of interest as containing a brief against restrictive regulation in this matter. The following remarks from Mr. Stone's letter speak for themselves and require no further comment:

"The provisions of the so-called Berlin treaty are such as to stifle the progress of the art by making the natural development of non-interfering apparatus useless and unprofitable. It tends to take away from the inventor, the engineer and the manufacturer all incentive to perfect the art to that point at which mankind may be able to profit to the maximum from this wonderful, flexible and economical mode of instantaneous intercommunication. Where many progressive, but separate and distinct nations are crowded together on a continent, as are the European nations, such a convention as the Berlin treaty may, perhaps, to a certain extent, be excused in spite of its unnecessarily restrictive character; but, for the United States, having for itself the greater part of a continent—far remote from these nations—to join with them in such a convention would be, I believe, a grave and inexcusable mistake.

"The experts in wireless telegraphy of the United States Navy would like to have such laws enacted as would give the United States Government unrestricted use of all wave-lengths between 600 meters and 1,600 meters. This would leave only the least desirable wave-lengths for the use of the wireless business of the country, and bring about an altogether intolerable condition in the transaction of business by wireless telegraphy. Moreover, it would free the United States Navy from the necessity of using any but the cheapest and least efficient wireless apparatus and would tend to indefinitely postpone progress in the art.

"If the United States Government's naval stations and ships were equipped with as efficient wireless apparatus, *i. e.,* as "selective" wireless apparatus as that used in the German Navy, they would not be so easily interfered with by every little amateur's station in their neighborhood. In this connection it is to be remembered that the amateur of today will be the inventor and engineer of tomorrow, and if he be prevented from freely experimenting now his attention and interest will probably be permanently diverted from the subject of wireless telegraphy with loss not only to himself, but to the community at large."

In connection with the prevention of disasters similar to that which overtook the *Titanic,* an invention by H. T. Barnes, professor at McGill University, which was recorded in the list of patents last week (No. 1,022,526) is of considerable interest. Professor Barnes proposes to detect the presence of icebergs at sea, even when they are not visible, by the effect upon the temperature of the water at the sides of the ship. His apparatus, which is essentially a differential electrical-resistance thermometer, shows the temperature-gradient of the water at the ship's side and it is presumed that this, when in the neighborhood of an iceberg, will be altered from its normal value. The instrument is so sensitive that it is capable of measuring a gradient of one-tenth of a degree per mile. Tests already made show that such an apparatus would be quite capable of detecting an iceberg at a distance of two miles, and if the *Titanic* had been equipped with such an instrument there is no doubt but what its destruction could have been avoided.

It was peculiarly fitting that the address by Mr. Marconi before the New York Electrical Society should have come just at the time when the result of his inventions was being instrumental in the saving of so many human lives. This address is given in abstract on other pages of this issue.

Window Lighting Discussed by Chicago Illuminating Engineers.

A meeting of the Chicago Section of the Illuminating Engineering Society was held in the Great Northern Hotel, Chicago, on the evening of April 18. The nominating committee submitted the following names as nominees for Section officers for the ensuing year: W. E. Barrows, Jr., chairman; T. H. Aldrich, secretary; F. A. Vaughn, S. E. Church, J. W. Foster, Edward Wray and J. R. Cravath, managers. Preston S. Millar, general secretary of the Society, spoke briefly of his trip to the Pacific Coast, from which he had just been returning, and referred to the International Engineering Congress which is to be held at San Francisco in 1915. He felt that the Coast was a very fertile field for the development of illuminating-engineering activity.

The paper of the evening was presented by J. Henninger, of the engineering department of the National Electric Lamp Association. It was illustrated by a large number of lantern slides and also several window-lighting fixtures, particularly reflectors of the modern types. Mr. Henninger stated that window-display lighting in its inception was usually accompanied by a large amount of glare, since the practice of outlining the entire window with exposed lamps was very common at first. He defined good window illumination as that which makes the goods displayed stand out effectively without drawing attention particularly to the manner of lighting. The intensity of illumination to be provided depends upon the locality of the store, the standard of illumination in the community, the class and color of goods displayed, and the form of the window. The presence of glaring high-power street lamps directly in front of the window spoils any effective lighting of the window itself.

Mr. Henninger urged strongly that glass backgrounds should be avoided, as these almost invariably cause specular reflection of the light sources. Mirrors above all should not be used, because they not only exaggerate this effect, but they cause a multiplicity of reflections, detracting from the goods displayed, and present even the possibility of seeing the reflection of some competitor's store on the opposite side of the street. Great care must be taken in the selection of the background, contrast effects being usually very effective. For instance, if light goods are to be displayed, a dark background is desirable and if black goods are to be displayed a light background is needed. The lamps should be placed to throw their light down and back.

He described a window in which 40-watt lamps were placed in ceiling boxes, each having an area of two square feet and being one foot deep. This gave an effective illumination of from 16 to 20 candle-feet on the plane of dress. This arrangement practically hid the lamps and gave an excellently diffused light. The energy consumption of 20 watts per square foot was, of course, excessive; but th result was very satisfactory. Mr. Henninger considered good diffusion as being as important in this work as the elimination of glare. Low first cost of the equipment is not necessarily desirable because it usually involves decided sacrifice of the advertising effect.

The discussion was opened by Albert Scheible, who asked about the effectiveness of tubular incandescent lamps and about the use of gas arcs mounted directly outside of the window and provided with a reflector hood to throw their light into the window. Mr. Henninger said that the use of tubular lamps is for the most part very effectively carried out, but he was not at all enthusiastic about placing gas arcs in the manner described. H. B. Wheeler called attention to the desirability of getting uniform illumination in the plane of dress parallel to the window as well as at right angles thereto.

A. D. Curtis gave a brief history of window lighting. Trough reflectors were used originally, generally with hit-or-miss results, and almost invariably with great loss of light. Several years ago his firm had made a study of the requirements for window reflectors and had developed three types to meet the three general classes of conditions prevailing. He felt that the ideal lighting of show windows should be like that of a stage setting, with the lights entirely hid from view. Mr. Scheible said that in the lighting of show windows one must study psychology as well as illuminating engineering. He felt that in some, perhaps few, cases it was desirable to allow lamps to be exposed where it was the intention not so much to have the merits of the goods seen as to draw the attention of passersby and entice them to enter the store.

J. R. Cravath considered the problem of window lighting as being about seven-tenths window design and window trimming, and perhaps only three-tenths illuminating engineering. The shape of the window influences the effect very decidedly; in laying out a new store the shape of the window should be carefully selected to give effective results. It is very difficult to light tall, shallow windows with any degree of uniformity. Relatively deep windows are much easier to light properly. The questions of diffusion and shade go hand in hand. The most effective lighting doubtless is obtained by the use of a number of small lamps at the upper front edge of the window, each equipped with an appropriate reflector for the conditions prevailing.

Preston S. Millar dwelt on the need of many small merchants who put flaming arcs outside their stores to draw the attention of the people. He felt that color contrasts are perhaps as important as the selection of light and dark backgrounds to contrast with the line of goods displayed. The early use of trough reflectors gave fairly good results in many instances, as far as it went. He considered that window lighting was the first form of lighting which showed the value of concealing the light sources so as to concentrate the attention upon the things illuminated. He recommended testing the illumination by placing a white sheet in the plane of dress and making a series of surface-brightness tests with a photometer.

Alfred Johnson spoke of the difficulty of seeing goods properly at that time of the day when the sun is shining brilliantly. Serious reflections of the windows on the opposite side of the street detract from the display within the window at that time, and he hoped some method would be devised for illuminating the window during the day to overcome these difficulties.

T. H. Aldrich considered window lighting to fall into two general classes —first, as show or spectacular lighting and second, as true window-display lighting. Cheap stores use the first extensively, whereas high-class stores use the latter almost exclusively. He thought it was desirable to drop the curtain in the upper part of the window at night to cut off the specular reflection from glass in the upper portion. Mr. Aldrich recommended the desirability of regulating the amount of light furnished to suit the character of the display, that is, if dark goods are to be shown during a certain period, more light is evidently needed than when these goods are replaced by light articles.

Mr. Henninger briefly closed the discussion by answering a number of the questions that had been asked. He agreed that following the practice of stage lighting will give excellent results in show-window lighting. Commercial reflectors cannot be designed to meet every conceivable condition. For average conditions they are quite satisfactory now. He also agreed that there is a great waste of light in most show windows.

Fred G. Dustin.

The elimination of electrical hazards is a subject in which all electrical men and the public at large are vitally interested. During recent years, through concerted action on the part of many interests, there have been evolved definite methods of construction which, together with the employment of tested materials and devices, have brought safety and order out of uncertainty and chaos.

In the development and application of these methods a new profession has been created in the electrical-engineering world, that of the electrical inspector. The importance of his calling has rapidly increased with the phenomenal growth of the electrical industry and the almost universal but extremely diversified applications of electricity to all phases of domestic and commercial activities.

Successful inspectors of today have gained recognition only by constant and conscientious effort along lines of educating self and public, square dealing with all clients, vigorous enforcement of duly adopted rules and the exercise of consistent, broad-minded, but uniform interpretation of them. One of the most successful of them is the subject of this sketch.

Fred G. Dustin was born in Minneapolis, Minn., August 12, 1872, and received his education in the grade and high schools of that city, and at the University of Minnesota. This was supplemented by practical work in several branches of the trade, including journeyman construction work, the development and manufacture of power and signal apparatus, electrical contracting and telephone engineering, until December, 1899, when, after competitive examination, he was appointed city electrical inspector of Minneapolis.

Fred G. Dustin.
Chief Electrical Inspector, Minneapolis, Minn.

As chief inspector he has served the city continuously during these past twelve years, in which period Minneapolis has become recognized as one of the most progressive and modern cities, electrically, in the country.

Mr. Dustin is a member of many social and technical organizations and has always taken a prominent part in their activities, having been past-master of his Masonic Lodge, treasurer of the State Board of Electrical Examiners, founder and several times president of the Minneapolis Electric Club, president of the Northwestern Electric Show Association, and chairman of the Executive Committee and president of the Western Association of Electrical Inspectors. He is an associate member of the American Institute of Electrical Engineers and an honorary member of the National Association of Stationary Engineers.

He has written many technical papers, several of which have been published in these columns, and has delivered several addresses before technical societies. He has always been much interested in educational matters and has been in charge of the Electrical Department of the local Young Men's Christian Association schools for about seven years.

He is an original thinker, showing inventive ability along several lines, his latest patent being a very ingenious alternating-current motor-starting switch which was on exhibition at the recent third annual Electrical Exposition at Minneapolis.

People's Electrical Page in Chicago.

A "People's Electrical Page" has made its appearance in Chicago, having been published in three dailies. The scheme is essentially the same as followed in a number of other cities.

Several papers have taken up the proposition and it is planned to have the page appear once each week in one of the papers.

Pittsburgh Jovians Smash Records.

All records of the Sons of Jove were broken by the Jovian Electrical League of Pittsburgh Saturday evening, April 13, when 170 electrical men were initiated in the English room of the Fort Pitt Hotel and 319 Jovians banqueted in honor of the new members. The record, with 150 new members, was previously held by Schenectady, which took the honors from New York, which admitted 114. Denver had held it for a year with 110.

The Westinghouse Electric & Manufacturing Company employes assisted largely in establishing the new mark, many officials being among those initiated. E. M. Herr, president of the Westinghouse company, was made an honorary member and the prominent Westinghouse officials initiated were: Harry D. Shute, acting vice-president; S. H. Anderson, assistant treasurer; F. S. Ballyeat, assistant sales manager; C. S. Doran, assistant superintendent; W. K. Dunlap, assistant to the vice-president; J. J. Jackson, attorney; Alexander Taylor, manager of works; E. R. Cate, district manager Westinghouse, Church, Kerr & Company; E. H. Sniffin, sales manager Westinghouse Machine Company.

Other prominent men admitted were: Carl Seyler, general manager Hubbard & Company; G. F. Freed, general superintendent National Metal Moulding Company; J. P. Kennedy, manager Stinson, Kennedy Company; Joseph S. Myers, editor *Post* and *Sun*; R. M. Irwin, secretary; A. M. Peterson, auditor, and J. E. Trower, advertising manager *Post* Publishing Company, and F. R. Fortune, district manager Cooper Hewitt Electric Company.

Statesman W. D. Shaler and Jupiter Robert L. Jaynes were in charge of the ceremonies. The degree team was composed of Henry Harris, Jupiter; H. C. Owen, Neptune; M. F. Knapp, Pluto; Saul Lavine, Vulcan; F. C. Albrecht, Hercules; James L. Thompson, Apollo; E. H. Sutton, Avrenim; W. D. Shaler, Mars.

At the banquet, at which Statesman Shaler was toastmaster, Jupiter Robert L. Jaynes, Harry B. Kirkland, S. L. Nicholson and H. H. Cudmore spoke. F. C. Albrecht, on behalf of the Westinghouse Company, presented Statesman Shaler a gavel.

Meeting of Car-Lighting Club.

The regular monthly meeting of the Car-Lighting Club, the Chicago branch of the Association of Railway Electrical Engineers, was held on the evening of April 17. George W. Cravens addressed the meeting on the subject of "The Planning and Equipment of Railway Shops," treating the matter exclusively from the point of view of the steam railroad company.

The subject is such a comprehensive one that Mr. Cravens contented himself with giving merely an outline of it, but enlarging upon certain features in detail, such as motor drives, etc. He also brought out much valuable data on the power required to drive the various types of machine-tools under different conditions of service and the percentages of each of the various kinds of tools required in railway shops.

After all the necessary preliminary data are secured and the size and location of the shops are settled, the arrangement of the buildings and their equipment must be determined. Under the heading of "Layout" Mr. Cravens discussed this subject. The various kinds of shops required were then taken up in rotation and their arrangement, size, equipment, etc., discussed.

Both alternating and direct current are being successfully used in shops of all kinds, many shops having one kind or the other exclusively. As to the advantage of electric drives and lighting over other kinds there is very little room for argument or question.

Mr. Cravens then explained the characteristics of each of the three kinds of continuous-current motors, series-wound, shunt-wound and compound-wound, and then showed which class of service was best for each motor.

The characteristics of the different kinds of alternating-current motors were treated the same way, synchronous motors and asynchronous or induction motors being described in detail. The various forms of induction motors were described and the applicability of each kind stated. Mr. Cravens stated that induction motors had been developed to such a point that they are good for almost any service now.

As to the proper-sized motor for a given purpose, there is no better way to determine this than to put a motor on the machine and take readings of the current under different conditions of operation, but a close approximation may be obtained by the following:

$$H = F \times D \times S \times C.$$

Wherein F is the feed in inches; D, the depth of cut in inches; S, the cutting speed in inches per minute; C, a constant depending upon the material, and H, the horsepower.

The values of C are as follows: Cast iron, 0.35 to 0.40; soft steel or iron, 0.45 to 0.50; hard and machine steel, 0.70 to 0.80; and crucible steel, 1.00 to 1.10.

Mr. Cravens also emphasized the fact that the average load of a machine shop seldom equalled more than 30 per cent of the combined rated capacities of the motors connected, and that it was therefore advisable to consider the possibility of grouping such machines as drill presses, grinders, etc., in order to keep down the motor cost. The low cost of maintenance and the saving in line losses were also emphasized, as compared to mechanical transmissions.

International Association of Municipal Electricians.

The seventeenth annual convention of the International Association of Municipal Electricians will be held in the Hotel Jefferson, at Peoria, Ill., August 26 to 30, 1912.

The International Association of Municipal Electricians is composed of municipal electricians from all parts of the United States and Canada, as well as from Cuba and South America. Its objects are the acquisition of experimental, statistical and scientific knowledge relating to the constitution, equipment and operation of fire and police telegraphs, light, heat and power systems, and the diffusion of this knowledge among the members of the Association with a view to improving the service and reducing the cost thereof, and the establishment and maintenance of a spirit of fraternity among its members.

The president of the Association is John W. Kelly, Jr., chief of Electrical Bureau, Camden, N. J., and the secretary is Clarence George, city electrician, Houston, Tex. The chairman of the Executive Committee is W. E. Wolgamott, city electrician, Peoria, Ill.

New York Jovian Lunch Club.

On Wednesday noon, April 17, the New York Jovian Lunch Club was addressed by John F. Gilchrist, president of the National Electric Light Association. The subject was "Public Service," the speaker outlining the development of effort and the growth of the idea of centralizing power supply. Mr. Gilchrist spoke in high terms of the healthy growth of the Order of the Rejuvenated Sons of Jove, and the importance of their co-operation for the improving of the relations existing in the electrical industry.

At the meeting of the Electric Club of Chicago on April 18, upon the motion of E. F. Kirkpatrick, those in attendance arose and paid a silent tribute to the victims of the *Titanic* disaster.

Depreciation and Replacement of Telephone Equipment.

At a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and of the Electrical Section of the Western Society of Engineers held in the Society's rooms on the evening of April 22, Burke Smith, of the Chicago Telephone Company, read a paper entitled "Depreciation and Replacement of Growing Telephone Plants."

The paper opened with an analysis of the development of electric utility companies, which has three stages. The first, being largely pioneer and development work, is rather slow. The second represents a period of rapid extension after the value of the utility becomes familiarly known. The third stage represents a period of saturation when the growth corresponds quite closely with the increase in population. This represents a relatively slow and stable development. Mr. Smith reviewed the development of the telephone industry of this country, pointing out that most companies are in the second stage of development.

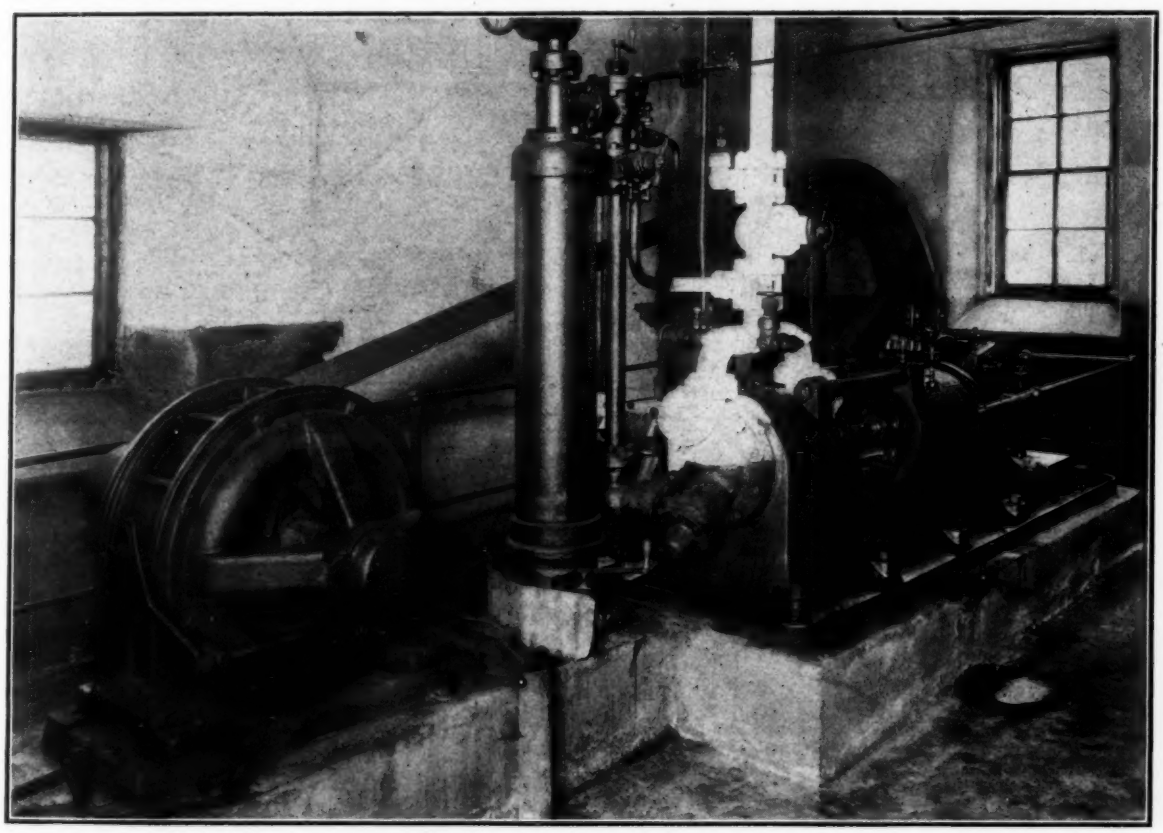
In telephone properties obsolescence has been and still is a very large element of depreciation. It must be noted that the telephone plant has no overload capacity. It must be equipped to handle any possible maximum demand. The author defined the natural life and average life of the various elements of any utility plant. The average life of different parts of a telephone plant varies considerably. Therefore, it is difficult to arrive at what might be known as the composite life of the property, the latter being a fictitious but nevertheless valuable term to represent the average of the average lives of the different parts of the plant.

All replacements should be made out of the earnings of the property. In general, three different methods have been made use of to take care of replacements, the first being out of capital account, which is decidedly undesirable. The second method considers replacement just the same as operating maintenance. This is a desirable method, but in the case of telephone properties it probably must be modified to a certain extent. The third method provides a depreciation reserve fund. The factors on which this fund depends are always more or less uncertain, but careful records enable a fairly average life to be placed on the different parts of the plant. Considered as a whole, the composite life of telephone plants in very large cities varies from 11 to 14 years. In a rapidly growing plant the replacements are at first relatively low, because extensions can be made with modern equipment.

Electricity in Breweries.

An analysis of the operating conditions in a majority of the average-size breweries will show that power costs are sufficiently high to admit of central-station competition. Substantiating figures are presented in this article, together with information on the selection of motors, horsepower requirements and complete power data on six typical installations.

Because breweries require a considerable amount of steam in their operations, central-station companies have been more or less reluctant to enter this field, believing that, save in a few isolated cases, the cost of central-station power could not be made sufficiently attractive. On the other hand, where power solicitors have approached brewery managers the latter have in a majority of cases ignored the arguments presented, due principally to an erroneous idea as to the true power and steam costs in their plants. As a result, there are today a great many breweries in this country which could effect a considerable saving in their operating costs by the substitution of central-station power.



Motor-Driven Compressor—E. Fleckenstein Brewery.

A prominent consulting engineer of Chicago, who has made a special study of brewery conditions and is recognized as an authority on the subject, confirmed the foregoing by a statement to the writer that under present operating conditions in 99 per cent of the breweries in this country, operating costs are greatly in excess of what they would be in modern, well designed plants, and as a result a majority of the breweries could effect a saving by purchasing power from central stations.

In spite of statements to the contrary, however, experiences of central stations in a number of cities have demonstrated that brewery business is very difficult, and at times impossible, to secure. In the principal cities will be found mammoth breweries operating their own steam-electric plants efficiently and at a cost that does not admit of central-station competition. Occasionally, also, a smaller plant will be found where unusual attention has been given the power proposition and where efficient and economical operation is being obtained. Where such plants are found central stations should not ignore them as hopeless prospects but an effort should be made to supply part power for operation on certain days of the week; for overtime service; or for operating additional machines that may have been added to the original equipment. This practice is carried on in Chicago and elsewhere with excellent results. The business is profitable, but of greater importance is the fact that in case of breakdown or any emergency the central station will be able to demonstrate that cost is secondary to reliability of service.

The majority of breweries, however, are of such a size—50,000 barrels per year and under—that they can economically purchase central-station energy for all of their requirements, generating steam for cooking and hot water from their own boilers. The following data are presented with the view of assisting the central station in securing that class of business which will be mutually profitable to both

the central station and the brewing company.

The advantages to be gained through the introduction of electric power in industrial properties are in no instance more apparent than in the brewery, where the number of varied shop processes, requiring more or less power for the operation of machines of nearly every character, embrace many of the more generally known manufacturing industries upon a more or less extensive scale.

Mechanical transmission requiring long lines of shafting, innumerable belts of all sizes and other mechanical appliances, the continuous operation of which, for the delivery of small quantities of power at points remotely located with relation to the main engine room, or long lines of steam piping for the delivery of steam into engines located in the outlying departments, are sources of constant loss, continuing throughout all hours of operation.

A modern brewery affords many opportunities for the profitable introduction of electricity as a power-distributing and lighting medium. Few industries have need for so many comparatively small amounts of power applied in widely separated departments as does a brewery. In meeting these conditions electricity is being employed and is an ideal means of transmission. It is clean, simple, positive and flexible, allowing extensions and additions to be made to the various buildings or the construction of new departments extending over a wide area; it makes power application in such developments possible at low cost for transmission system and increases greatly the efficiency of the whole establishment.

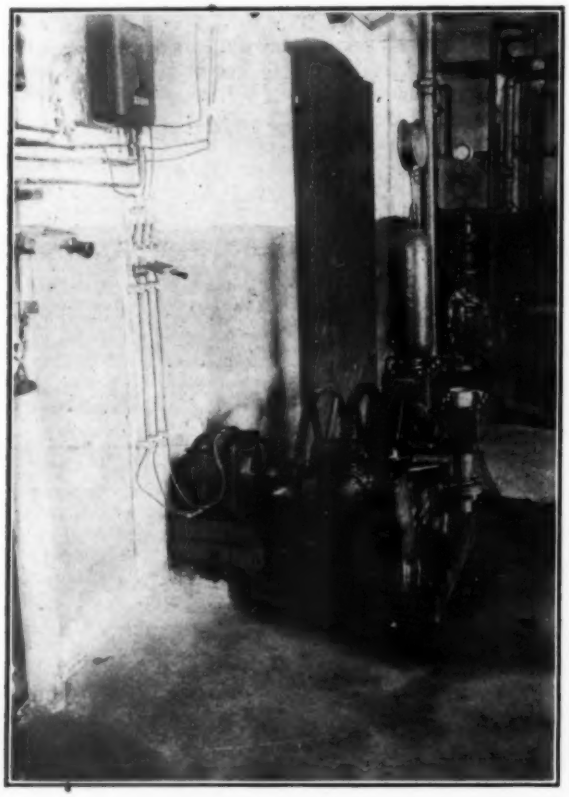
Of all the advantages of motor drive for breweries the three most important are cleanliness, simplicity, and reliability. Cleanliness, if not voluntarily strived for by the brewery manager, is nevertheless compulsory in this age of stringent pure-food laws, and while the kind of machinery used has less to do with the cleanliness of the product than in any other industry, still the absence of grease, oil, dust, etc., which is characteristic of motor drive, should be an important feature to breweries.

The importance of the demand for simplicity is at once recognized when it is considered that by far the greater number of brewery employees are unskilled foreigners. Electric motors are practically foolproof and can be operated by simply throwing a switch. Reliability of operation is a feature that can only be fully appreciated by a brewer who has had to stand the heavy loss of a spoiled brew due to failure of power. The question of reliability of power, at least for the brew house, is alone of sufficient importance to dictate the adoption of central-station power. The process of brewing is a continuous one and a breakdown when the ingredients are in the mash tub means the loss of all the grain, in addition to loss of time, etc. It is of course unnecessary to elaborate here on the unquestioned reliability of central-station power.

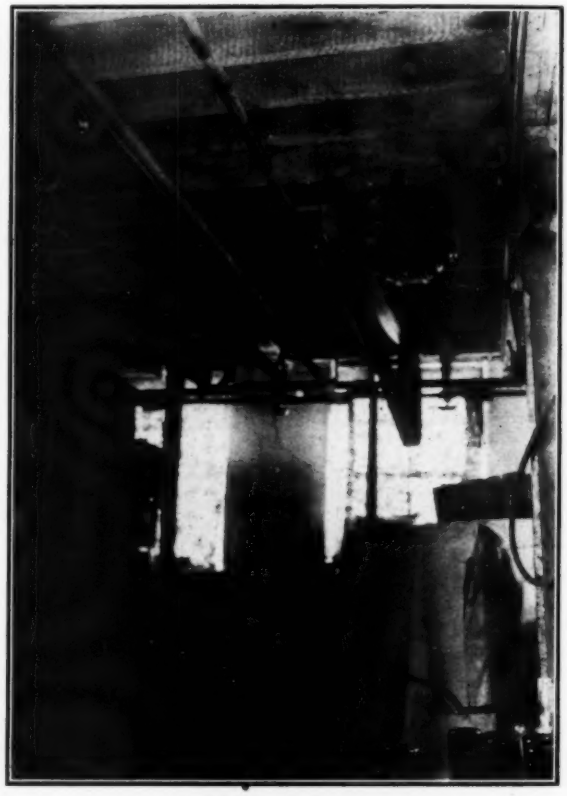
Electricity Versus Steam.

In soliciting the adoption of electric drive for breweries, a great proportion of success depends upon the ability on the part of the central-station solicitor to correctly analyze existing plant-operating expenses and fixed charges. Ability to do this readily and correctly will go far to demonstrate definitely and convincingly to a prospect the flaws and waste and general field for improvment in his power layout.

As heat as well as mechanical power is required for the complete cycle of operations in breweries, in determining the relative merits and economies of various systems of drives it is commonly held that the additional coal for sustaining sufficient boiler pressure to operate the engine is negligible when compared with the fuel needed solely to obtain steam for



Motor-Driven Pump.



Motor Driving Bottling Machines.

cooking and hot water. The engine is therefore considered to perform the function of a cheap and effective reducing valve between boiler and heating systems, practically generating at no cost the mechanical power required.

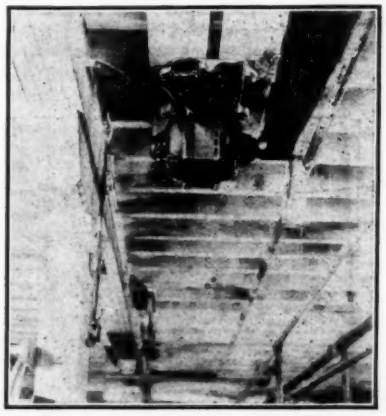
In brew houses live steam is required for cooking, hence a large portion of the total steam generated must be delivered at boiler pressure. In determining the thermal value of the exhaust from a low-pressure engine, due consideration must be given such variables as initial gauge pressure and point of engine cut-off, also taking into consideration radiation losses and leaks in main piping, engine cylinder, etc.

While under the best conditions it may be possible to realize at boiler pressure, 90 per cent of the heat units contained in the steam at boiler pressure, approximately one-quarter of this amount must be used for heating boiler-feed water, and after deducting for inefficient pipe and cylinder lagging, badly packed glands, leaky valves and joints and the loss chargeable to engine repair and depreciation, as well as the additional expenditure for oil, waste, packing, etc., is is evident that the value of the thermal units remaining for useful work may be considerably reduced. Also, when steam is used for supplying both power and heat, well sustained and constant gauge pressure is indispensable, if the gauge and the various driven machines are to be kept at normal speed and maximum rate of production.

It should also be remembered that in the transmission of steam to remote points in a brewery, in addition to condensation losses, etc., the increase in temperature due to this transmission necessitates the installation of larger refrigerating equipment than would be required were electric motors utilized to develop all the power needed.

Selection of Motors and Power Requirements.

The selection of motors for brewery drive presents no especial difficulty. Where alternating current is available the polyphase induction motor with squirrel-cage windings is of course preferred. This motor is extremely simple and may therefore be built to withstand hard usage and to run continuously in exposed locations and under disadvantageous conditions. The high efficiency obtained in this motor over wide load ranges and the small attention it requires while running, make it compare favorably in cost of operation with motors of any other type.



Motor on Ceiling in Bottling Shop.

In the case of mash and rice tanks the slip-ring motor should be specified due to the heavy starting torque of these motors. With these machines, also, the motor should be back geared to the bevel gearing of the tanks. Back-geared motors are also preferred for grain conveyors. In practically all other instances direct connection by belt or gearing is advocated. In wash houses and bottling works the question of space is a serious one and it is very often desirable to mount motors on the ceiling. In fact this has frequently been a good talking point for solicitors. Compound-wound motors should be used where the supply source is direct current.

When applying alternating-current motors to refrigerating compressors it is preferable to use the squirrel-cage motor for the smaller sizes, while the larger machines will usually require a wound motor on account of the high starting torque required. In using chain or gear drive, care must be observed to have bearings and shafts of sufficient strength to stand the severe service.

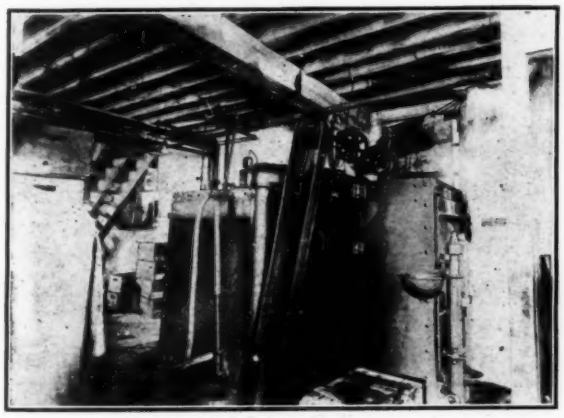
The power required to drive a refrigerating machine depends to a great extent upon the temperature of the water used to cool and liquefy the compressed gas. The lower the temperature of the water, the smaller the amount of power required.

Some figures on the horsepower required to drive refrigerating compressors are given herewith.

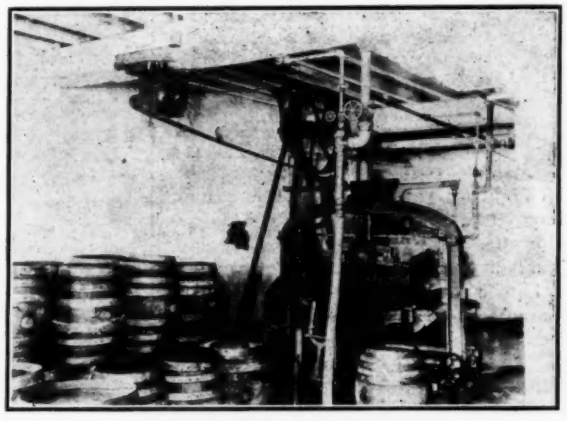
REFRIGERATING COMPRESSORS.

Capacity Tons Refrigeration.	Horsepower Required.
0.5	2
1	3
2	5
4	7.5
5	10
7.5	15
10	15
15	25
20	35
30	50
40	65
50	80

The temperature at which beer must be held is 33 degrees.



Motor Driving Pasteurizer.



Motor Driving Keg Washers.

BREWERY MACHINES.

Name.	Horsepower Required.
Screw conveyors	3 to 10
Mixers—dry	5 to 15
Mixers in mash tubs	15 to 25
Malt grinder	10
Malt cleaner	7.5
Bucket conveyors	3 to 15
Pumps	5 to 10
Hop sifters	2
Drying kilns	5
Belt conveyors	3 to 10
Exhaust fan	3 to 15
Barley cleaner	5
Barley mixer	5

As a rule rice cookers require one horsepower to each 10-barrels capacity and mash tubs one horsepower to each

five-barrels capacity. In the field of electric heating, glue and resin heaters, branding irons and beer-vat dryers can be used to advantage. With the latter a temperature of 100 degrees Fahrenheit, sufficient to dry a 50-barrel vat in 10 hours, is obtained at a consumption of three kilowatts per hour.

Comparative Cost Figures.

The following figures comparing the cost of steam and electric operation in a brewery located in the Northwest are significant in that they show a saving of over $5,000 in favor of central-station power. The steam-operating figures were taken from the books of the brewery and approved by the manager. The costs charged to central-station operation were based on complete tests carried on jointly with the brewery and the central station. In explanation it should be stated that this brewery also conducts a malting plant and it was found that one-half the total annual consumption of coal was burned to furnish heat for this plant.

STEAM OPERATION.

Coal	$12,521.60
Engineer	1,200.00
1 oiler	1,095.00
Extra oiler (26 weeks)	429.00
3 firemen	6,570.00
Oil, waste and packing	250.00
Repairs to engine, boilers, pipes and pumps	900.00
Total	$22,965.60

CENTRAL-STATION OPERATION.

Energy	$ 5,824.00
Coal for non-power purposes	6,260.80
Engineer	1,200.00
2 firemen	4,380.00
Oil, waste and packing	50.00
Repairs, boiler, packing and ice machine	200.00
Total	$17,914.80

SAVING.

Steam costs	$22,965.60
Electric costs	17,914.80
Saving	$ 5,050.80

The figures on central-station costs were based on an installation of 200 kilowatts. The significance of these figures is further emphasized when it is known that the electric company guaranteed to maintain the saving shown.

Brewery Wiring.

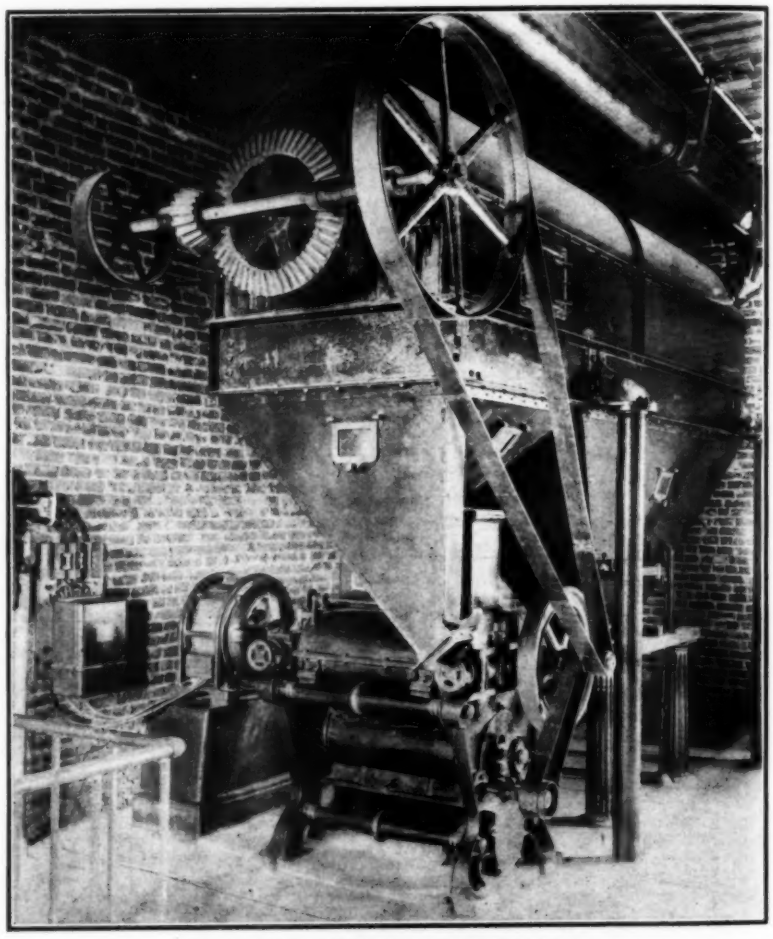
In wiring breweries for electric light and power, many difficult problems present themselves. Moisture, ammonia and gases which prevail in breweries make it necessary to have the best and most lasting insulation for the wires. Open-knob wiring is best suited, as conduit, no matter how well painted and covered with asphaltum, will in time corrode. At the threads near junction and outlet boxes, which are the weakest parts of a conduit system, this corrosion is most active. The one-piece tie knob is often to be preferred here to split knobs, as the latter do not maintain as good insulation resistance as tie knobs. The moisture may work down the screw to the wire. Special blocks of wood well soaked with shellac or tar are first secured to the wall or ceiling and then on these the knobs are supported. This gives ample separation of the wires from the wall. A coat of asphaltum paint over the tape keeps out moisture and ammonia fumes. Ammonia attacks copper vigorously.

The location of fuses and switches is also important in breweries. These cannot be installed open on the walls because of the moisture, the ammonia and other corrosive vapors, and also because of the liability to mechanical injury. In this case again all-metal cabinets have usually been found to be somewhat inferior to impregnated-wood cabinets. These cabinets are lined with heavy asbestos or transite board, set away from the wall and have a cover closing on a slant and having a small window. An ordinary eight-candlepower lamp is kept burning and this keeps the box dry and also makes it easy to find.

Porcelain, hard rubber or composition weatherproof keyless sockets may be used. Where porcelain sockets are employed they should be kept out of reach as they are easily broken. In the tank cellars, wash rooms and compressor rooms, the open-knob system, described above, may have a slight preference. Where switch cabinets are not used waterproof switch inclosures are adapted.

Electric Vehicles for Delivery.

The electric vehicle has been making remarkable strides in the brewery industry, one manufacturer alone having over $1,000,000 worth of vehicles now operating in this service throughout the country. The economy, reliability, simplicity and cleanliness of this method of transportation is worthy of the attention of both the small and large brewery.



Motor Driving Malt Cleaner and Grinder.

There are now available to central-station men complete data on electric-vehicle operation which should be carefully compiled and presented to the brewery manager. The Peter Doelger Brewing Company, of New York, a few years ago had in service over 120 horses; today the company operates 36 electrics. With the horse-

(Continued on page 797)

Brewery Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Brewery, name withheld, having an average yearly output of 30,000 barrels of beer. In summer eight brews per week are made, and about six per week during the winter. There are 30 men employed, working 10 hours per day. Group and individual drive.

Total connected horsepower, 255; number of motors, 10; average kilowatt-hours per month, 18,080.

Kilowatt-hours per month, for twelve months: June, 28,630; July, 42,150; August, 33,240; September, 11,360; October, 19,600; November, 21,600; December, 8,230; January, 980; February, 950; March, 2,690; April, 24,960; May, 22,560.

Load-factor, 13 per cent; operating-time load-factor, 27.2 per cent.

The electrical energy consumption per 1,000 barrels brewed is 7,200 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed, with their respective drives. All motors are of the induction type, squirrel-cage windings, except where indicated.

No.	Horse-power	Speed R. P. M.	Type	Application.
1	150	600	Slip-Ring	Belted to a 10-foot shaft (three hangers) and to the flywheel of a Linde ice machine; flywheel, 120-inch diameter, rim 28-inch by 3.5-inch, 56 revolutions per minute. Cylinder 24-inch diameter by 30-inch stroke. Ammonia pressure, 150 to 180 pounds. Motor pulley 24-inch diameter.
1	75	600		Belted to a 20-foot shaft (four hangers) and to countershaft of a Linde ice machine. Flywheel, 180-inch diameter, rim 12-inch by 5.5-inch. Ammonia pressure, 150 to 180 pounds, 68 revolutions per minute. Cylinder 18-inch by 24-inch stroke.
1	1.5	1,700		Direct-connected to a Magnus beer pump.
1	2	1,120		Direct-connected to a Magnus beer pump.
1	5	1,700		Belted to a two-hanger shaft and a 20-foot shaft (four hangers), driving one Magnus keg washer and one Loco Magic pulp washer.
1	10	1,120		Belted to a 50-foot shaft (seven hangers), driving one 4,000-pound freight elevator, one Olsen & Tilgner malt-mill roll, 10-inch by 8-inch, and one 8-inch by 50-foot bucket elevator.
1	7.5	1,700		Belted to a two-hanger shaft driving a mash tub of 200-barrel capacity.
1	2	1,120		Belted to a 40-foot shaft (seven hangers), driving one bottle soaker, one Eick 16-bottle cleanser, one Crown Cork & Seal Company bottle-capper; flywheel, 16-inch diameter; rim, 4.5-inch by one-inch.
1	0.166	1,150	Single-phase	Geared to an Economic Machine Company labeling machine.
1	2	1,120		Belted to a Loew New Era pasteurizer.

The supply source is three-phase, 440-volts, 60 cycles.

E. Fleckenstein Brewing Company, Faribault, Minn. Individual drive. Running hours per week, 60.

Total connected horsepower, 46; total number of motors installed, 5; average kilowatt-hours, per month, 5,737; average kilowatt-hours, per month, per connected horsepower, 125.

Kilowatt-hours, per month, for six months: May, 4,720; June, 5,740; July, 7,233; August, 6,723; September, 5,730; October, 4,280.

Load-factor, 26.8 per cent; operating-time load-factor, 47.8 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. All motors are three-phase, 60 cycles, 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	35		Belted direct to one 25-ton Linde ice machine, manufactured by the F. W. Wolfe Company.
1	3	1,700	Direct-connected to pressure pump, used for circulating brine.
1	3	1,200	Belted direct to one 25-barrel pasteurizer.
1	3	1,800	Belted to one keg scrubber.
1	3	1,200	Belted direct to one deep-well pump.

Energy for this installation is supplied by the Consumers Power Company.

Cataract Consumers Brewery, Niagara Falls, N. Y. Individual drive.

Total connected horsepower, 165; total number of motors installed, 7; average kilowatt-hours per month, 30,728.

Kilowatt-hours, per month, for twelve months: January, 11,664; February, 4,727; March, 6,720; April, 11,554; May, 39,897; June, 50,678; July, 56,391; August, 57,364; September, 53,381; October, 43,862; November, 17,433; December, 11,073.

Load-factor, 34.2 per cent. Maximum for year, 106 kilowatts, in July.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 25 cycles, 440 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	75	750	Belted to ice machine.
1	30	750	Belted to grain conveyor.
1	20	750	Belted to grain conveyor.
1	10	750	Belted to washing machine.
1	10	750	Belted to bottling machine.
1	10	750	Belted to elevator.
1	10	750	Belted to grain conveyor.

Energy for this installation is supplied by the Niagara Falls Power Company.

Brewery Data—Sheet No. 2.

Gipps Brewery, Peoria, Ill. The capacity of this brewery is 2,400 barrels per month, while the average output is 1,200 barrels. Nine men are employed, working eight hours per day. Beer is brewed three times per week, requiring eight hours per brew. Group drive.

Total connected horsepower, 72; number of motors, 10; average kilowatt-hours per month, 672.

Kilowatt-hours per month, for twelve months: January, 520; February, 643; March, 486; April, 536; May, 670; June, 863; July, 1,131; August, 953; September, 787; October, 523; November, 473; December, 482.

Load-factor 1.7 per cent; operating-time load-factor, 4.4 per cent.

The approximate electrical energy consumed per barrel is 0.43 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. All motors are squirrel-cage induction machines, two-phase, 60-cycles, 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	15	1,120	Belted to 15-foot shaft (two hangers), driving one No. 3 Columbia malt mill, 10-inch by 18-inch rolls (Olsen & Tilgner), one 8-inch bucket conveyor; 60-foot vertical lift.
1	3	1,120	Belted to the countershaft of a 40-barrel rice cooker, 36-inch by 4.5-inch driven pulley, capacity 2,600 pounds of malt in 30 minutes.
1	15	690	Geared to countershaft of a Schneible mash tub, 250 barrels capacity.
1	3	1,700	Direct-connected to a J. Schneible 10-inch centrifugal beer pump.
1	15	1,120	Geared to Taber Pump Company special rotary grain pump.
2	3	1,700	Each direct-connected to a Schneible carbonating pump, 147 revolutions per minute, 30-60 barrels per hour.
1	5	1,120	Belted to a 24-inch agitator in the refrigerator brine tank.
1	5	1,120	Belted to 20-foot two-hanger shaft, driving one Loco Magic filter washer (Lowe Supply Company), one grindstone, 28-inch by 5-inch; one Olsen & Tilgner keg washer.
1	5	1,700	Belted to a six-foot shaft (two hangers) and one three-hanger, 10-foot countershaft, driving one Eick 16-bottle cleanser, one Crown Cork & Seal Company bottle capper.

Energy for this installation is supplied by the Peoria Gas & Electric Company.

Kalispell Malting & Brewing Company, Kalispell, Mont. Group and individual drive. Running hours per week, 48.

Total connected horsepower, 86.5; total number of motors installed, 5; average kilowatt-hours, per month, 1,335; average kilowatt-hours per month per connected horsepower, 15.45.

Kilowatt-hours per month, for seven months: June, 918; July, 2,321; August, 1,895; September, 1,726; October, 1,114; November, 940; December, 439.

Load-factor, 2.8 per cent; operating-time load factor, 7.5 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives.

No	Horse-power	Speed R. P. M.	Application.
1	50	900	Belted direct to one 25-ton ice machine.
1	3	1,800	Belted to circulating brine pump for ice machine.
1	10	1,200	Belted to a line shaft, driving one No. 5 Monitor malt-cleaning, polishing and separating machine; one Printz grader and separator; one grain elevator.
1	15	1,200	Belted to line shaft, driving one power shovel, one corn shovel, one corn cooker, one grain elevator, and one malt grinder.
1	5	1,800	Belted to miscellaneous bottling machines.
1	3	1,800	Direct-connected to centrifugal pump.
1	0.5	1,800	Direct-connected to labeling machine.

Energy for this installation is supplied by the Northern Idaho & Montana Power Company. The supply source is three-phase, 60 cycles, 440 volts, save in the case of the 50-horsepower motor, the voltage of this being 220.

Gulf Brewing Company, Utica, N. Y. This plant has a capacity of 60,000 barrels of ale per year, while the yearly output is from 22,000 to 25,000 barrels. Ten men are employed, eight working nine hours per day and two working in two shifts of eight hours each. Group drive.

Total connected horsepower, 50; number of motors, 7; average kilowatt-hours per month, 175.

Kilowatt-hours per month, for twelve months: January, 140; February, 150; March, 130; April, 210; May, 300; June, 180; July, 150; August, 110; September, 100; October, 330; November, 150; December, 160.

Load-factor, 0.6 per cent. The electrical energy consumption per 1,000 barrels is 80 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 440 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	10	690	Coupled to a Kaestner & Company malt-mill grinder (two 24-inch by 14-inch diameter rolls; capacity, 200 bushels per hour).
1	15	690	Geared to a Kaestner & Company agitator (200-barrel capacity), speed 12 to 14 revolutions per minute.
1	5	1,120	Geared to countershaft of bucket elevator (25-foot lift, eight-inch by five-inch buckets).
1	5	1,120	Geared to the countershaft of a 12-inch bucket elevator (65-foot lift, eight-inch by five-inch buckets).
1	5	1,120	Connected through a two-inch Morse chain to the drum mechanism of an Otis 3,000-pound freight elevator.
1	5	1,700	Belted to a six-foot shaft (two hangers), driving one Loco Magic filter washer.
1	5	1,700	Belted to countershaft of an F. Awe keg washer.

Energy for this installation is supplied by the Utica Gas & Electric Company. No bottled beer is sold.

drawn vehicles the cost of delivery per barrel of beer was 33.7 cents; with the electrics it is 24.75 cents, a saving of 8.95 cents per barrel. Similar figures from a great many other plants are available and should convince the most skeptical that the electric is the logical vehicle for brewery delivery.

Typical Installations.

No better example of a typical electrical installation in a brewery can be given than in the George H. Glennon Brewery, located in Pittston, Pa. In building this brewery, everything was arranged for the best and most modern practice, involving what is termed the "gravity plan." By this is meant that in each department the raw materials and beer are elevated but once

Electric Truck for Brewery Delivery.

to the highest point in the building, whence, in progress from one stage of manufacture to the next, they fall or flow from floor to floor by gravity.

It is obvious that a vast saving in both power and labor will accrue from the continuity of operation obtained through this method of manufacture. It is claimed that for an equal yearly output the cost of operation in older plants of poor design or faulty arrangement is as much as double that of the plant under discussion.

The process of brewing, as carried on at the Glennon brewery is given herewith. The plant is divided into three departments; viz., the elevator or mill house, the brew house, and the cellars. Each department is operated on a separate gravity plan for the transfer of materials. In the first department (the elevator or mill house), the grain is taken from a car and dumped into a hopper leading to the basement, where it is caught up by an endless belt-bucket conveyor and carried to the storage bin or hopper on the top floor of the building. The conveyor is operated by a 7.5-horsepower, back-geared motor, as slow speed (about 35 revolutions per minute) is required on the driven shaft. The malt then passes through a slide in the bin and drops into a scale hopper, where the desired quantity is weighed out, then through the screening reel into the malt mill, where it is crushed for the mash. One 7.5-horsepower direct-connected motor drives a blower for dusting the grain and carrying off the chaff from the rolling screen. The malt mill is operated by a 10-horsepower motor at 500 revolutions per minute and has two smooth rollers, one of which is driven by the motor, while the other follows due to the friction of the grain between the two. Before the malt drops between the crushing rollers it has to pass over a series of permanent magnets, which catch and remove any tacks, nails, or particles of iron that might damage the roller surfaces. The prepared malt now passes to the basement and is again carried to the top of the building by the same conveyor that elevated it in its original state; but this time, instead of going to the same storage bin as before, it is taken by another conveyor to the storage bins in the second department, having now both completed the first gravity stage and finished with the first department.

The second department consists of the brew house. Here the crushed malt is deposited in two hoppers on the top floor by a belt conveyor operated by a five-horsepower back-geared motor, giving a speed of about 35 revolutions per minute on the driven shaft. With these hoppers the second gravity stage begins. Besides the malt, raw cereals—rice and corn grits—are elevated in sacks and stored for use as needed.

To form the cereal mash, the raw cereals and part of the crushed malt from the hoppers are weighed out in certain definite proportions and dropped into the cooker together with water from a cold-water tank. The cooker or converter is a cylindrical vessel made of iron and provided with a stirring device consisting of a central vertical shaft with radiating stirring arms placed in a spiral position one above another. These arms revolve at about 18 revolutions per minute, the shaft being driven, through a system of gears, by a 15-horsepower back-geared motor mounted on top of the converter. Steam is now applied to this mash, and due to certain temperature conditions and agitation, a chemical change takes place; and when the mass is properly gelatinized it descends through openings to the mash tub on the floor below. As the cereal mash drops into the mash tub, the remaining crushed malt in the hoppers is added, together with the proper quantity of water from the tanks.

The mash tub is used for extracting the valuable ingredients from the malt and cereals and further converting them into products desirable for brewing; it consists of a cylindrical vessel made of iron and supplied with a removable perforated bronze strainer, or false bottom, placed above the real bottom. The tub is further supplied with a stirring device for mixing the materials with water, a steam jacket for heating, and a sprinkler for supplying a spray of water to wash the grains. The stirring device is not only turned by the central vertical shaft, but has revolving paddles that keep the mash well mixed and the temperature uniform. The shaft is operated at about 10 revolutions per minute and is driven through a system of gears by a 20-horsepower back-geared motor. This is mounted on the floor directly under the mash tub. A non-rovolving shovel, located just above the false bottom, is used for throwing out the grain after the mash is finished and the wort or extract run off. The term "wort" is applied to the liquid obtained from the raw materials by the process of brewing proper, before it is transformed into beer by fermentation; in other words, it is the extract formed by the water in passing through the grain. Connected to the bottom of the mash tub is a series of copper tubes which convey the wort to a horizontal cylindrical copper vessel, called the grant,

from which it is pumped back to the mash tub or run into the kettle. After the wort is drawn off, there is no further use for the grain; it is therefore emptied into a tank, and after being drained off, is sold principally for cattle feed.

The kettle is the vessel in which the wort is boiled, for the purpose of precipitating the albuminoids, for extracting the bitters and oil from the hops, which are added at this time, and for concentrating the wort. The kettle is built entirely of copper, is pear shaped, has a hood to carry off the vapors, and a double bottom for a steam jacket. When the wort is thoroughly boiled and in proper condition it is put into the hop jacket, which strains out the hops contained in the wort after it leaves the kettle. It is next pumped from the hop jacket to the cellars, thus ending the second stage.

The wort is received at the highest point in the cellars, namely, the surface cooler or beer tank. From this point it begins the third gravity stage, descending by successive steps over the Boudelot cooler into the settling tubs, thence into the fermenting tubs and storage tanks, and finally into the chip casks, from which it is racked off into trade packages.

About sixty days are required for the beer to go through the third department, when it is ready for the trade. In this section of the brewery a motor is installed for driving the chip washer, and another for operating a small beer pump used for transferring beer from one tank to another. The chips are put into the beer during one of the last stages of the process, to take up the yeast germs. After the beer is drawn off, the chips are washed and used again.

The capacity of the brewery is 60,000 barrels per year.

Detailed information of six other breweries using central-station power is given in the data sheets.

Commercial Practice
Management, Rates, New Business

CO-OPERATIVE ELECTRIC LITERATURE IN ENGLAND.

By A. H. Bridge.

Some excellent ideas relative to central-station publicity literature are presented in this description of the successful methods of the Publicity Committee appointed by British central-station companies.

Less than two years ago English central-station companies, recognizing the value and importance of working co-operatively in the publication and circulation of development literature, launched a scheme for that object.

Some excellent work of the kind had been done prior to that date by authorities acting independently, and here and there good is still being done single-handed. The splendid efforts of the Newcastle-upon-Tyne Electric Supply Company are remembered as among the earliest really aggressive movements, and there were many who regretted the demise of the *Tyneside Electrical Pioneer*, the local publicity organ of this company, due to a change of policy. Local authorities and specialist publishers continue to produce plenty of useful "powder and shot" material, appealing pamphlets, humorous cartoons, and artistic prints—in color and otherwise. But the metropolitan authorities preferred not to continue along lines involving enormous waste of labor and heavy expense. They therefore joined hands as the Electric Supply Publicity Committee, with H. B. Renwick, managing director of the County of London Electric Supply Company, as chairman, and a great deal of admirable work has been done in a comparatively economical manner, chiefly in the publication of canvassing literature, but also in newspaper advertising and in other ways. The committee last year held its first annual conference in London, at which there were present engineers, managers, and municipal councillors from all parts of the United Kingdom.

The literature which has been prepared covers the whole field of the various uses of electricity—lighting, heating, cooking, power, ventilating, cleaning, etc. In less than two years nearly 100 different publications have been prepared, and the list of authorities which are making use of these in winning the interest and custom of householders and factory managers includes 54 companies; 11 in the British Colonies (Africa, Australia and New Zealand, and India); and 105 municipal stations in the British Isles. It is stated that the committee is in close touch also with other organizations, similar to its own, in Germany, America, and elsewhere, with a view to co-operative action. In the matter of joint publicity the committee claims to have led the way. It has been fortunate in having as its chairman, Mr. Renwick, who it is to be regretted, has just been obliged to relinquish that office, owing to increased responsibilities that have been placed upon him in connection with his own company. He has had as his vice-chairman A. C. Cramb, the chief of the Croydon municipal electric system, also F. J. Walker, of the Saint James' & Pall Mall Company, as honorary secretary, with a committee of 17 members representing some of the most influential light and power undertakings in the Kingdom. The editorial and executive offices are at Moorgate Place, London, E. C.

The total sales of publicity literature during the first year's operations ran up to about 1,500,000 copies, and they comprised every possible description of folder, circular, pamphlet, postal cards, adhesive labels, posters, show cards, etc. In particular cases the sales of individual items reached 150,000 copies. It is expected that the result of the growing use of such material will make the total output for the second year, which is now nearing its end, close upon 3,000,000 copies.

While some of the publications, such as "So Nice and Warm"—in which a couple of dogs are pictured smiling out their unbounded satisfaction seated on a rug before a luminous radiator—have had a larger sale than others because of their humorous nature, others will be favorites because of their high artistic qualities. Especially does this apply to one entitled "Electricity in the Home" showing in effective coloring the benefits accompanying the use of electricity in the drawing, dining, billiard and bed rooms, also in the nursery and the kitchen.

In the catalog of subjects covered in the lighting literature so far issued,

there are the following: spring-cleaning circular; electric light and health; "Don't Run Away" (intended to arrest attention); shopkeepers' booklet; electric light and eyesight; single-leaflet colored pamphlets on electricity for either the decorator or the florist, the hotel manager or the butcher or grocer; a similar series for engineers, bakers, printers, electroplaters, and sawmills; electric light and safety; analysis of gas; coronation circular (street illuminations); property-owners' circular; housewife's circular; "Electric Light the Safe Light"; "Power for All Machinery Users"; "Two Sides of the Power Question"; adhesive label "Stop!".

For heating, cooking and ironing there are appropriate posters, adhesive labels, post cards, radiators, booklets, heating leaflets, ironing posters and show cards; cooking and ironing mail cards and folders. The "miscellaneous" include: a domestic appliance folder; "Electricity and Pure Air"; electricity in the office; gas versus electricity; a nursery circular and a booklet on electrical apparatus.

The large posters are designed for display on public bill boards, and smaller ones and show cards suitably varnished so as to keep them as free as possible from dirt, are for display on central-station vehicles, etc. Show cards are further for service in managers' own offices and show rooms, and for display by wiring contractors either on their own premises or while engaged on a job. The circulars are, of course, intended for distribution either on a systematic posting plan or house-to-house canvass, or for inclosure with correspondence or accounts. Sometimes real-estate agents allow a pile of copies to be left on their desks for the use of house-hunters. Mail cards are for use for acknowledgement post cards, reply post cards, and for general notices regarding water-charging, inspection, etc.

Mr. Renwick urges the necessity for a strenuous and systematic publicity campaign both as preparatory and as supplementary to personal canvassing. He holds that central stations must regard themselves as vendors of a commodity just as ordinary tradesmen, and they must adopt equally enterprising and thorough methods of advertising. He further contends that it is only by concerted action and through the cumulative effect of the action of a large number of undertakings combining to give the hard push altogether that a really wide popularity for electricity can be obtained.

There is another department of the committee's work to which reference should be made. The newspapers had adopted the plan of reporting practically every fire as "due to the fusion of an electric wire." It was necessary to alter this, and the way to do it was by speedily correcting the misstatement with the ascertained facts of the case; for the phrase had caught on remarkably, was being clung to by reporters as of considerable convenience to them, and was being believed by the reader. Let me quote Mr. Renwick himself on this interesting point:

"This press work differs from our publicity work on account of what I may call its silent character. That is to say, it goes on from day to day unknown to the general body of the committee, with a letter here and a paragraph there, with a telephone message to this editor and a wire to that editor, from all of whom we have at all times met with the greatest courtesy and fairness. In this way we have tackled all the various unfounded rumors regarding fires which have taken place during the time of the committee's operations. These have been quite a large number and have covered a wide area both at home and abroad. This work, although it may not appeal to you in the same way as does publicity work, is none the less important, and it must be satisfactory for you to know that there is a central body here in London keeping a constant and careful watch over your interests in this respect, ready to act at a moment's notice.

The committee has done a certain amount of newspaper advertising, and in this direction it will go forward boldly to counteract an ambitious scheme of the same kind recently set on foot by the gas supply authorities.

One of the latest of all the efforts of the Publicity Committee is the publication of a quarterly journal relating to its own doings, for circulation among its own supporters, and affording a medium for the mutual interchange of ideas by electricity-supply publicity officials.

Birmingham Company Cuts Rates.

The central station rates in Bessemer, Ala., have been considerably reduced. For lighting customers the rate will hereafter be 10 cents per kilowatt-hour instead of 12 cents. For power business there is a demand charge of $1.00 per horsepower in addition to a meter rate of 0.75 cent per kilowatt-hour. Bessemer is supplied by the Birmingham Railway, Light & Power Company.

Electric Signs for Bootblacks.

In Omaha the bootblacks find the electric sign a very effective means of promoting their business. On establishments of this sort there are some attractive signs.

CENTRAL-STATION SERVICE.

By C. E. Daniells.

The success or failure of a motor installation may easily depend on the source of energy for driving the motors. However carefully the motors may have been selected and applied, the installation as a whole will be a failure unless the energy supply is steady, reliable and ample in quantity. Conditions may sometimes point to the wisdom of an independent power plant, although central-station service if available will nearly always be found preferable to power from such a plant. If a private power plant is installed, the characteristics of the current should correspond to those of the nearest central-station current, so that the latter can be utilized in cases of emergency.

If the local central-station management is alert and progressive, and if the energy is available for the installation under consideration, an isolated generating plant is rarely warranted. Even though a steam engine is in use for other purposes and it has enough surplus capacity to drive a generator large enough for the purposes desired, the use of central-station power may be, and generally is, more economical and satisfactory.

Some of the reasons for preferring central-station energy are greater reliability, greater convenience, decreased risk, decreased responsibility, more accurate knowledge of power used, and, all things considered, decreased cost. The actual cost of power for most industrial operations is a very small percentage of the cost of the product, and is therefore secondary to other considerations.

Probably the first consideration is reliability of service. Failure of power when needed is intolerable; it throws all the machines and hands into idleness, delays production, causes broken delivery promises and if of frequent occurrence or long duration, may easily cause losses greater than the whole cost of power.

The central-station equipment is designed and installed with the special purpose of insuring continual power supply, and the central-station operatives are thoroughly imbued with the idea that power must not fail. Enough equipment is installed to hold a portion in reserve for emergencies, something an isolated plant can seldom afford without adding very materially to investment, and therefore to cost of power. The central station being in business for supplying electric energy to a community, is usually of a size to enable it to install surplus power units such that the incapacity of one will not interrupt the supply.

What is said of power units also applies to operatives; no live central station will operate so short-handed that the temporary incapacity of an operator, or even of several operators will cripple it. An isolated plant, on the other hand, must depend on the services of a limited number of engineers and firemen,—perhaps one each, and the illness of one may shut down the plant.

Next in importance to reliability of power is its convenience or availability when needed. The modern central station supplying both light and power never closes down except in very rare emergencies, and even then the most strenuous efforts are made to get under headway again in the briefest possible time. Central-station power is therefore practically always available. In an industrial plant driven by motors using central-station energy, any machine can be operated any time, day or night, without undue expense. If the plant is driven by an engine or by motors supplied with energy from an isolated plant, the operation of a single machine necessitates running the engine and all the line shafting, or possibly a large engine and dynamo having capacity enough for the whole plant. With engine drive, or with an isolated plant, the cost of overtime work is therefore practically prohibitive, whereas with properly arranged motor drive and central-station service overtime work can be carried on with a power cost no greater than for the same work during regular hours.

The operation of a private electric power plant is connection with an industry, usually increases the hazards and often increases the insurance rates. This is especially true of a steam plant operating in proximity to the buildings in which the operation of the industry are conducted. Properly installed motor drive with central-station serice is without doubt the safest power supply available. With such power, all the risk of fire, smoke, cinders and dust from a boiler plant are avoided, as is also the vibration and noise accompanying the operation of an engine and dynamo.

The production of electric energy in a private plant in connection with an industry necessarily burdens the manager of the industry with responsibilities he should not be called upon to assume. The power plant is a side issue with him and yet his success depends on its satisfactory operation. However faithful or efficient the men he has employed to run this power plant, he must give it much personal attention, all of which detracts from his efficiency as manager of the industry. With central-station service he is relieved of all the details of power production and can devote his attention exclusively to the management of the industry.

Moreover, if electric power is purchased, the exact amount used is known, and measuring instruments can be employed to keep a record not only of the amount but also of the time when it is used. Any irregularities in the operation of the plant are thereby detected at once. The exact cost of power is made known to the manager on presentation of the power bill and without burdensome and expensive bookkeeping.

In comparing the cost of power generated in a private plant with that purchased from central station, all the foregoing items should be carefully considered since all of them affect the cost of power. Such consideration usually results in a decision in favor of central-station energy when such a supply is available.

A Mine in a Window.

It isn't a gold mine that's referred to in the heading to this note, but the window display shown in the accompanying figure should prove itself to possess at least one of the characteristics that gold mines are supposed to have: that is, it should prove a source of great profit to the power company in the front of whose offices the display appears. The photograph is a picture of a window in the offices of the Empire District Electric Company, in Joplin, Mo. Joplin, as is pretty well known, is in the heart of one of the richest lead and zinc mining districts in the whole country. A large part of the present business of the Empire District Company is furnishing power to electric motors used in mining operations. Nine years ago, however, this company wasn't selling any power at all to the mines. Its connected mining load now is in the neighborhood of 20,000 horsepower. This growth in the Empire District Company's load has not been a spontaneous, unstimulated process at all. On the contrary, it has come about because the company has had competent engineers making a thorough study of the problems of power applications in mining, and have had energetic salesmen present to mine operators the advantages of electric drive when electric drive has been seen to be the best.

Effective Central-Station Window.

The Empire District Company is still pushing the sale of power as vigorously as ever, and the show window is used to help the sales along. In the window there is a miniature mine in operation, and it's an electrically operated mine. The small house in the center of the picture contains the motor for driving the pump and the drill on the left of the house. In the right-hand side of the photograph the mill where the dirt is elevated and crushed and the ore separated out is seen. The display has attracted a great deal of attention since it was installed, a short time ago. For completeness and originality it is certainly hard to beat.

As the picture shows, the window also contains a map of the Empire District Electric Company's territory, with attractive reading matter to explain certain things about the map and the company's service. There are likewise photographs of some of the power houses, substations, and so on.

Electrical Construction

BOOKKEEPING FOR CONTRACT WORK.[1]

By Louis Levy.

In figuring contract work—that is, a plan and specification as submitted by architects—we use a form printed for the particular purpose. On one side of the sheet is room for itemizing each floor of the job, and if it is an irregular job, there is room for itemizing each room, with places for the number of outlets—whether center or bracket, also whether single, two, four lights, etc. On the same line as the outlet we have space for the plugs, switches, what circuit on the board, also the number of feet of conduit necessary to complete that particular outlet, also the wire, and a place for the labor necessary to install the particular material we have listed as necessary for the outlets marked. When we get through taking off a job, we have measured up every piece of pipe in the most particular way, and taken off our labor in so close a manner that we feel we are not guessing but actually figuring labor. We then add the quantities we have listed and this gives us the number of feet of conduit, wire, hours of labor, etc.

On the reverse side of the sheet we have columns for quantities, a printed list of material and column for price on each and in total; also a separate column for the finish of the job. We get our total quantities from the details listed, and in figuring our cost we use prevailing prices at which we can buy material.

We have used in past years, when we were doing bush and knob work, a method of averages at so much per outlet, but on conduit work we have not done enough to warrant us to try this method, unless we are not particular as to whether we get the job, when we use this method of averages to get a figure high enough to be safe.

After the amount of cost is arrived at, the percentage we expect to get as profit is added on and a bid is made out on printed forms for that purpose. At the present time we are adding 50 per cent of our cost to arrive at the amount we should bid on the job. The copy of the bid and the estimate itself are then filed in numbered envelopes. We use a 4-by-6 filing cabinet to index these envelopes, using the locations as the main index, and cross-index under architects, owners and contractors' headings. Our files now are as high as 4,300, each number representing something in the way of overhead expense without any guarantee of return for the investment.

We do not attempt, with very few exceptions, to follow up an estimate, believing that if we are low we will generally get the job.

When we do get a contract we open a folder in a filing cabinet, which is legal size, and head it by whatever letter of the alphabet it might be, and the next number; as, for instance, the Coliseum would be C, and if 97 was the last number under C that was used, the new contract would be C-98. All papers are transferred to this folder; a copy of the inspection report, also all papers which may refer to the contract, as well as plans, and we make a practice of getting a set of plans and specifications of every job we do, so that we can lay our hand on any plan asked of us for possibly five years back.

At the time of opening the contract, we enter the number in a small book, in which is kept the inspection number, a record of labor, and material tag numbers. These tag numbers are entered in this book before an order for material is filled, and we have by this means an index to all material charges which should be in the file when the contract is completed.

Up to now, we have not made an entry in our books to show we have this additional contract, and the making of the entry I am going to talk about gives us the following information: (1) Amount of contract work on hand; (2) amount of labor and material installed on unfinished contracts; (3) amount of money billed on unfinished contracts; (4) amount of gross profit on finished contracts; (5) amount of actual profit on contracts.

The entries are necessary for any one to keep his cost up to the minute and not, as most of us have done, leave it accumulate and, unless in special instances, never total up.

When we secure a contract, we make a journal entry charging an account called "Work to be Performed" and crediting a "Contract Account."

When materials go out, the cost is charged in total at the end of the month to an account called "Cost of Contracts" and credited to "Material Account." Of course, this means figuring cost of each material item, but if this is done, your material account tells you how much stock you have on hand continually, providing you charge material account with your purchases. I believe now that most of you depend on your yearly inventory to tell you what your stock is. We post cost of each material item to loose sheets headed "Cost of Contract Sheets," having a separate sheet for each contract, and the total of these sheets must correspond with "Cost of Contract" in the ledger. We do the same with labor; we have a labor account same as material, and this account tells how much is paid, while the "Cost of Contract" account is charged with what is paid. Each item is posted to the contract on which it applies, and the total of the labor charged on these cost sheets must correspond with the total of what shows in the labor columns of the "Cost of Contract." This is the part which must be kept up as you will see later when, at the end of the month, the finished contracts are taken out from the unfinished contracts.

When the job is roughed in, we send a bill calling for 75 per cent of the contract, as a rule. We use one copy of the bill as a journal entry and the other is filed in the folder mentioned before when we first opened the contract. The journal entry is posted as follows: the "Accounts Receivable" account is charged and the "Work to be Performed" account credited. As this "Work to be Performed" account now stands it shows the amount not billed on contracts which are on the books.

When the contract is finished, or rather at the end of the month, all finished contracts are handled together and the cost of each contract is charged to "Finished Contracts" and credited to "Cost of Contracts." We get the cost of each contract from our cost sheets, which you will remember were to be posted each day. The result of this entry is that all the cost of material and labor on contracts which are finished and which had been charged to "Cost of Contract" account are balanced, and the account continues to show the amount of labor and material invested in unfinished contracts. This is the part that appears to me of much importance. How many of you, when you are asked by Bradstreet or Dun or your bank or your jobber for a statement of how your assets and liabilities stand, could swear to the amount of labor and material invested in unfinished work and tell the

[1] Paper read at meeting of Electrical Contractors' Association of San Francisco.

amount billed against this investment without wanting a day or two to check up?

Another entry is made of the amount charged for a contract. This amount is charged to "Contract Account" and credited to "Finished Contracts."

The result of this entry is that all finished contracts are taken from what shows in "Contract Account" as live contracts, and this account shows now what total of work is actually under way, while the "Finished Contracts" shows the total gross profit on all work finished, the cost having been charged, and the amount secured being credited.

In writing the above explanation of the bookkeeping entries we make use of to get a true statement of our contracts, I do not give you any idea of the cost of keeping this work straight, yet every one of you will admit that you attempt to do the same thing in your own way. The method as outlined was given to us by a firm of accountants who installed in 1906 the system of tags and records we are using. We have made changes in several details, but I have not found anything that will give us the results we want in any other manner. We go a great deal further than the above because we want to know our profit each month, and we apportion our overhead expense to each job, using the labor on each job as the best basis on which to figure the expense burden, but I would not advise any of you to attempt to do this. Our business permits me to watch this end of the work and it certainly takes a large portion of expense to get what we get, but we could not change for all the money we have spent.

To show the advantage we have in having one of the firm on the inside all the time, we would say that during the month of February we did $789.40 worth of work on jobs between $10 and $50 on which we made 55 per cent on our selling price, or 123 per cent on our cost.

We also know that on the last 200 contracts we did we charged $43,544. Our cost of labor, material and sundries was $27,325, and our percentage of profit on cost was 59.6 and on selling price 37.2.

These results we get by close buying and watching our labor. We would sooner pay a superintendent a large salary and have every move of our $5.00-a-day men count, than pay two $5.00-a-day men to do in their own way what one man with intelligent superintending can do.

I have talked system and methods in the past, and believe that I have been consistent in practicing what I preach. I believe that during the past five years our firm has known more fully where we have stood on our estimates and our cost of finished contracts than any other firm, and we have already shown a willingness to discuss these matters with any one who would be willing to listen.

Service Rules in Omaha.

Very little investigation is needed to convince one that good practice in the matter of making service connections and that of installing meters properly is by no means so general as is desirable. For this reason some of the larger central stations distribute printed rules, governing services and meters, among the electrical contractors doing business in the locality served by the central station, and refuse to connect to services not installed in accordance with the rules. This plan is followed by the Omaha Electric Light & Power Company.

The booklet containing the rules which this company requires to be observed devotes the first page or so to a brief statement of the kind of power the company furnishes in the different sections of the city. In this statement the voltages and the frequency of the current offered the consumer are specified. It is then explained that the company furnishes its patrons carbon-filament lamps in sizes from 4 to 32 candlepower, inclusive, without charge, and that 2-candlepower sign lamps are also furnished free. Arc lamps are furnished and trimmed for a rental of 50 cents per month. The regulations concerning services and meters, as given below, then follow.

Service.

The following rules must be observed by all licensed contractors and persons doing electrical work in Omaha, South Omaha, Dundee, Benson, Florence and other places served by this Company.

All wiring and electrical apparatus must be installed in compliance with the rules of the National Board of Fire Underwriters and city ordinances having jurisdiction thereover.

All work must be inspected by the City Electrician, or the Omaha Electric Light & Power Company's inspector and approved before this Company will make its service connections.

It is the practice of this Company to run its wires to the point of entrance of buildings occupied by its patrons. It is, however, to be clearly understood that the Company reserves the right to designate where the entrance shall be made and may refuse to connect any installation in case the entrance is not satisfactorily located.

The Company will designate the location of service entrances for any one filling out information blanks furnished by the Company for that purpose.

No service wires smaller than No. 10 B. & S. gauge may be used. Rubber-covered wire is required.

All service wires must be protected by the proper tubes or conduit fittings.

All service wires must be concealed from point of entrance to meter board and must be provided with approved main-line fuse and with switch of ample capacity to carry full load plus 25 per cent.

All wiring intended to be used as flat-rate service for either light or power must be run in conduit.

The main fuses and switches must be located at the meter, as it is to the interest of the consumer as well as to that of the Company that this apparatus should be in a fairly convenient location and accessible at all times.

All service entrances in the underground district will be made through an outside wall in the basement at a point designated by this Company; or in case there is no basement in the building where the service is wanted, at some other point designated by the Company.

All services must be terminated in an approved sheet-metal box, made of No. 16 gauge or thicker metal.

All service boxes must be securely mounted on the wall at point of entrance and must be mounted so as to allow at least one inch or more of air space between the wall and the box backing.

All boxes must be built large enough to allow at least three inches between the sides of the box and the switches and fuse box after they are installed.

All service boxes intended for the use of two or more different kinds of services, must have a partition securely fastened the full depth and height, separating the one kind of service from the other. The Company also recommends that where slate-base switches or fuse boxes are used, that they be mounted on knobs, so as to allow for air spaces between the bases of same and the inside back of the box.

All holes made in service boxes intended for the entrance of service cables, must be made in the bottom of the box. The contractor who installs the box must punch out or cut out the holes large enough to receive the cables.

This company requires all of its customers who install direct-current motors for operating elevators, to have their service connected by a double-pole automatic circuit-breaker of sufficient capacity to handle the current required and of an approved type. In buildings where more than one elevator is installed, the main service wires may be equipped with a circuit-breaker of sufficient capacity to handle the entire load, or at the option of the customer, each individual motor may be equipped with a circuit-breaker.

All cable connections and changes of cables will be made by the Company's underground department, and in no case will the Company allow contractors, electricians, or other persons to make the cable connections, splices or changes.

Meter Loops, Boards and Cabinets.

Meter boards or meter cabinets must not be placed in the following locations: Bathrooms, bedrooms, pantries, closets or any part of a building that is not reasonably accessible to meter readers and meter testers, or where the presence of the Company's meter readers, meter testers or inspectors will be of annoyance to the consumer.

No meters will be installed in locations subject to extremes of temperature, outside of buildings, over doors, or behind doors, pictures, pianos, furniture, cellar stairways, or high up in the recesses of cellar ways, or in any place where the meter is liable to be damaged by persons or by any movable objects passing it.

No meters will be installed on temporary partitions, or walls that are not rigidly supported, or any framework that will subject the meter to vibration.

Meter boards must not be placed lower than five feet nor higher than

eight feet from the floor, except as provided for above.

All meter boards and meter loops must be built so that there will be at least four inches clear space on all sides of the meter after it has been installed.

All meter cabinets must be built with doors to swing on hinges, so as to allow at least four inches clear space on all sides of the meter after it has been installed.

All meter loops must be built with the source or feed side of the loop to the left-hand side of the meter, and the load side of the loop to the right-hand side of the meter.

All potential or shunt wires on meter loops must be soldered to main wire and no meter will be installed where this rule has not been strictly adhered to.

In basements that are very damp and where the service and meters are to be located in such places that would leave the meters liable to damage, the meters must be located in a service box or separate meter cabinet, furnished with suitable board to fasten meter to.

This company will not install a meter where wires of the loop are not long enough to properly install the meter. The contractor must see that at least 15 inches of wire is provided for each leg of the meter loop.

Fuses to cover the complete installation of a system or systems of wiring must be furnished by the wiring contractor who installs the fuse cutouts.

The dimensions and connections of meters used by this Company for single-phase lighting meters, two and three wire, are shown in Figs. 1, 2, 3, 4, 5 and 10. Three-phase meters, Figs. 6 and 7. Direct-current meters, Figs. 8 and 9.

All meters must be protected by a main-line switch and fuse box between the meter and point of service entrance.

The standard type of meters used by this Company are front-connected, and no back-connected meters will be installed.

Meters will be installed by this Company's meter men and in no case will this Company allow others than Company men to break meter seals, tamper with, or move meters. Consumers or contractors must notify this Company whenever it is found necessary to move a meter.

The figures referred to above are inserted as a sort of appendix to the pamphlet of rules, and all dimensions of meter boards are specified and the proper connections for watthour meters of various sorts and capacities are made clear.

Incandescent Lamps on 25-Cycle System.

The Empire District Electric Company operates motor-generator sets for supplying current for lighting in Joplin, Mo., this being done because the company's power stations develop only 25-cycle power. The 25-cycle current is used, however, in lighting the company's offices and other premises, and is found to be satisfactory for the purpose. It is stated that there is no annoying flicker with either carbon-filament or metal-filament lamps.

A COMBINATION OF CONDUIT, MOLDING AND OPEN WORK.

By H. G. Wilson.

While conduit is to be recommended as the best type of electrical construction, yet a combination of the several methods in use makes, under favorable conditions, as good and lasting a job, as where conduit is used throughout.

The installation herewith described, replaced a very old wooden-cleat, concealed style of wiring for branch circuits, which had been from time to time rendered even more hazardous with the addition of metal ceilings, etc., through which the two circuit wires were brought out for the outlets in half-inch holes and in contact with the sharp metal edges; also when a circuit was out of order the engineer did his best to patch up the trouble, which resulted in the usual condition found when maintenance of this sort is depended on. An urgent request for improvement from an inspection department, coupled with the owner's desire to obtain a more efficient lighting system than the old one, which consisted of old-style arc lamps for general illumination and incandescent lamps strung around wherever one happened to be needed, were the reasons for rewiring.

The private plant consisted of a 25-kilowatt generator, belt-connected to a 35-horsepower slide-valve steam engine, and it might be interesting to note here that from the switchboard, the feed wires were run straight to the top of the building in molding, without porcelain tubes, etc., and down again to the first floor. No taps were taken off except on the downward return, which resulted in a fifteen-volt drop on the floor directly above and nearest to the dynamo. The theory of this method is puzzling and an answer would be interesting.

It was necessary to replace several meters and switches; so a new marble switchboard was installed from which a two-inch conduit was run containing two 225,000 circular-mil cables. Up to the first floor and from there an inch-and-a-half conduit containing two No. 1 cables was run to the top of the building; the cable was not reduced in size above the first floor, to allow for plenty of room for additional load.

Steel cutout cabinets and approved panel boards were used for the protection and control of branch circuits.

The first floor, used for display purposes, was illuminated with 100 and 150-watt tungsten lamps, circuits for which were run in conduit from the panel board to the ceiling and branched off through conduit fittings to molding placed along the side of the ceiling beams to the fixtures. The upper floors were wired open on cleats from the cutout cabinets as the ceilings are unusually high and there is practically no opportunity offered for disturbance or damage to the wire. Molding was used for switch legs, for pan and portable extension receptacles and also from the cabinets to the ceilings. As the light on these floors had to be concentrated, 40 and 60-watt tungsten lamps with reflectors were placed at the required location.

That part of the basement used for the power plant, elevator motors, and repair shops was entirely rewired in conduit and the remainder, used for the storage of books and stationery, was wired open on the side of the beams; and wherever there was a possibility of the lamps being left in contact with inflammable material they were incased in approved guards.

The principal reason for using this style of work was that it is not so expensive, which had to be considered, as the building may be torn down in six or seven years; but there is no reason why, with proper maintenance, it should not give as good service as a straight conduit job. None of the circuits were loaded above 500 watts, so that room for an additional light, when necessary, was provided for.

History of the Code.

A. M. Schoen, writing in a recent number of the *Southern Electrician*, gives an interesting account of the evolution of the National Electrical Code.

It is pointed out that prior to 1895 each section of the country had its own electrical rules, which were enforced by local boards of underwriters having jurisdiction. The confusion incident to this state of affairs was great. There was no definite method of passing on either devices or materials, nor any definite standards to govern their manufacture. Efforts were made from time to time to relieve these conditions, but nothing final was accomplished until 1895.

In the year just mentioned a meeting was held in New York, at which time a committee selected the best rules from those in force in various sections, and these were grouped in a pamphlet known as the "Rules and Requirements of the National Board of Fire Underwriters."

The Natonal Electrical Code finally replaced and superseded what had been known as the Underwriters' Rules. Changes in engineering practice are now closely followed and the Code is revised by the Electrical Committee of the National Fire Protection Association when revision is deemed necessary, a new edition being issued every two years.

CONCERNING SAFE WIRING.[1]

By Waldemar Michaelsen.

If all wiring was safe and done in strict accordance with the latest modern rules, electrical inspectors would be out of a job. Electrical inspectors therefore recognize in many of the central station men some of their very best friends, who are doing their utmost to keep them working full time. As most inspectors are paid by the month and therefore do not want to work overtime, a word to you central station men from an inspector may not come amiss.

Whether safe wiring, in the strictest sense of the word, be a commercial possibility or not I shall leave unsaid. To the best of my belief, there is no such thing as absolute safety in this world, no more than there is such a thing as matter being at rest. I have heard the argument: As there is no such thing as safety, let us not waste our efforts on something we cannot reach. This may be an argument, but is surely a bad one. Because we cannot attain perfection, there is no reason why we should not aim to get as near perfection as possible.

I might say as a general proposition, that I do not think electric wiring is any grave danger to either life or property. We must admit, however, if we accept the teachings of experience, that defective electric wiring has, without a shadow of a doubt, caused the loss of life and destruction of property. It is to avoid this, that we have organized to formulate a set of rules by which electric wiring should be done.

It has often been said that the National Electrical Code, as it exists today, is the product of insurance companies, who have promulgated these rules in self-defense for their own pecuniary gain at the sacrifice of central station men, consumers, and everybody else in the electrical business. This is a mistaken idea, even though it may have been right at the beginning; but instead of looking down on the insurance companies for such action, we owe them, in my judgment, a debt of gratitude for having taken the first step in the most important promotion of our profession. This step should undoubtedly have been taken by municipalities, central station men, or others interested in this matter, but it was never accomplished until the insurance companies took the first step.

The National Electrical Code is considered by many people as a compilation of foolish and insignificant details and the requirement of many things which are not necessary at all. As to the first, I grant, that the Code goes into a good many details; but is it not a fact that trouble seldom arises from the big things, while it is all the little things that cause trouble? The main wires and the main system of an electrical installation hardly ever give cause for trouble; but it is the little inaccuracies, the little additional attachments, and the little things that are left undone or improperly finished, that are generally the cause of bad results. Is it therefore any wonder that the Code goes into so many details and isn't it as a matter of fact absolutely necessary that it should? The Code throughout is simply based on good common judgment and the results of years of experience by users, lighting companies, contractors, engineers and others. The Code as it exists today is not the product of insurance companies, nor any one interest in the electrical business, but is the consensus of opinion of good wiring by the most prominent and competent people in the various branches of our profession. To disregard the Code wilfully, therefore, puts the perpetrator in the ridiculous attitude of thinking he is right and the entire electrical profession is wrong.

It has often been argued that it is impossible to follow the Code, because it changes so often. This is rather an antiquated idea and would simply show that the person who uses this argument is not keeping abreast with the developments of electricity that have been made necessary to make it a commercial success nor with the varied conditions and purposes under which electricity is used and for which it is employed at the present time.

From this we will therefore see that the rules we have are not so bad, when viewed a little bit from a disinterested standpoint; the great problem that mainly confronts us is how to get these rules enforced.

I can already hear some of you say: "It is out of the question to enforce these rules in my town, because it would mean that all the wiring in town would have to be condemned and re-installed." Such is not the case at all. There is a much easier way out of it. Even an electrical inspector does not expect to reform the entire country in a day, a week, a month, or even a year. But let me say this to you, that if you could get all wiring done in your city or town from now on, put in in accordance with the requirements of the Code, it would not be long before such construction would become the standard and a great deal of the old work would not have to be condemned, because many of the owners would want it fixed up to look like the modern work for their own self-protection. With the assurance that such adoption of the Code for all future work would not mean the tearing out of all existing wiring, it ought not to be difficult to get an ordinance passed or get a ruling made by the local lighting company that no new wiring will be connected, except it complies to these rules. A lighting company can issue such a ruling in self-defense, in order to avoid accidents. With a little persuasion from the beginning on some people to explain to them why work should be done in this manner, it would soon become a habit to have work done in accordance with the Code. I know some of you will object to the alleged increased cost of first installation, but this is only imaginary. It is a national peculiarity of ours that we always kick on cost, no matter whether it be high or low, no matter whether we know what the work is worth or not. For that reason you will have no more kick on a good installation than you will have on a poor one. My suggestion, therefore, is that in order to get on our way to the top of the ladder, let us get upon the first step first, without worrying about how we will make the rest of the way. Let us make a united effort to have all work in Nebraska from now on done in accordance with the Code.

You will often hear it said that if we could just have a law and a fearless officer to enforce it, we could force our patrons to do what we want them to do. This sounds very well, but it doesn't work out near as well as it sounds. Any law that contemplates a change of this kind, can only be enforced as we get the public educated to the need of such law. The fearless officers of the law are not to be secured at bargain counters nowadays. Most of them are found in fairy tales and novels, or else running for a third non-consecutive term. There is nothing so provoking to an American citizen as to be told that he must comply with the law just because it is a law; and if you go at an improvement in this way, you will generally accomplish nothing, except to get into court and then you may have to hold your breath for maybe two or three years. The only way to enforce a law of this kind is to have the person or persons intrusted with such enforcement use diplomacy and tact, rather than fearless wielding of the big stick. You must explain the law to them and show them wherein the danger of noncompliance with the law lies.

It is a disputed question whether you can condemn old wiring, particularly if such has once upon a time been passed by the city. But even in

1 A paper read at the fifth annual convention of the Nebraska Electrical Association.

such cases, there is an easier way out of it than to fight with the law. Let me in this connection cite you an instance: A certain installation in this city was in a badly worn and dilapidated condition from years of deterioration. I am perfectly satisfied that if I had given notice to this owner that such wiring was condemned, the matter would have gone into court, thus permitting the danger to continue to exist until such case could have been disposed of. Instead of that, I gave the owner notice that this installation was, in my judgment, in a very dangerous condition. Such notice was given in writing by personal delivery. I then explained to the owner, that if anything should happen due to the defective condition of this wiring, whereby I would be held responsible by the court, he would share in this responsibility as he had full knowledge by written notification of the existing danger and if I therefore should be escorted to a prison cell, he would probably occupy one in the same hostelry. It is an old saying that when you touch a man's pocketbook he will stop and take notice, but I have found it equally true that whenever you pin responsibility onto a man in such a manner that he cannot shake it off, and he will yield to your request in self defense.

Before closing let me say a word to you in regard to state inspection. A bill was introduced at the last session of the Nebraska Legislature to provide for state inspection. In framing this bill, the same old mistake of making the bill too far-reaching was made and the bill was defeated. It is contemplated to take this matter up again with our Legislature next winter and I would like to ask your co-operation. The most important thing for the bill to cover is state inspection of intercity and inter-borough pole lines to prevent the dangers now existing to lighting companies, as well as telephone companies from crosses on pole lines over which no one now seems to have any control. The next thing to cover will be inspection of wiring in towns and cities that have no local inspection. Let us frame the bill, however, carefully and rather have it cover too little than too much. If the bill proves satisfactory, it will be easy to enlarge on it and even though it may take years, we will get a good start in the right direction. Your co-operation, for instance, by a committee appointed for this purpose, will be greatly appreciated by those working on the measure now and would in my judgment be of great benefit to the safety of electrical installation throughout the state. As a summary of the condition, therefore, in our aim to secure safe wiring, I might say, that we have all the material necessary on hand and it is simply up to us to use it. To work it, requires diplomacy, tact and patience, but no more than lies within the power of the average central-station man. It is up to the men in the electrical profession to do the work necessary to raise the standard; we must not wait for our patrons to come and ask us to please do so. The only way to do a thing is to do it, and why is the present time not as good as any to make the start?

If any of the suggestions submitted herein should appear to you as feasible and can be put into use without further delay, the purpose of my appearing before you would be accomplished and your actions would bring our profession forward one big step by permitting us to deliver our product to the consumer on safe wiring.

Effect of High Voltage on Insulating Materials.

A recent number of *Electrical Engineering* reports some interesting and apparently important tests on insulating materials. Experiments were performed with a view to ascertaining whether damage to electrical machinery was more likely to be caused by a short application of a high voltage or by a longer application of a lower voltage. A special motor-generator, a transformer giving pressures up to 100,000 volts, and a special electrostatic voltmeter were provided, and in the first series of experiments varying numbers of layers of sheet materials were tested for breakdown voltage between special-shaped brass electrodes. It was found that when several thicknesses are tested the voltage per sheet falls as the number of sheets is increased. When only two or three layers are tested the voltage per sheet rises. This is due to the thinness of the sheets, as the weakest parts of a sheet are generally much weaker than the average when the sheets are of very thin material. On putting two or three thicknesses together, the weak spots in one sheet are generally covered by stronger parts of the others.

The results of the experiments on oiled fabrics show that when subjected to voltages sufficiently high to break down the surrounding air, a rapid decrease in electric strength is produced, which is largely due to the damage produced by the brush discharge. This action is the more pronounced when a few layers of material are tested, as the surfaces in contact with the metallic electrodes suffer most. This effect increases with time, and as a comparatively small lowering in voltage corresponds to a great increase in the time required to produce rupture, the effect of a long application is very generally more deleterious than that of a short application of a higher pressure.

The object of the second series of experiments was to study the energy absorbed in the insulation, as it was thought that a direct measurement by an electrostatic wattmeter of the energy dissipated within the insulating material would throw light on the nature of the electric stress on the insulation, and would render the effect of humidity and temperature (which had caused some irregularity in the breakdown tests) more easily traceable. The connections were arranged so that the wattmeter needle was only subjected to half the full voltage, and a special arrangement of guard rings and mica shields was devised to minimize the edge effect of the disc electrodes employed. Measurements on a few layers of oiled fabrics made in this way showed that the energy loss in the insulation suffers but little permanent change in many hours. Some air is inclosed in the layers, and no doubt the oxygen present is soon used up in oxidizing the surface of the materials. A low atmospheric temperature diminished the rate of temperature rise by the reduction in the initial watts, and so delayed the rupture of the material. The curves of energy developed show a very slow rise if the initial temperature is low, but as the temperature is higher the rise takes place at an increasing rate, becoming eventually almost "explosive," the sudden kick up of the curve, presaging the breakdown of the material, coming sooner the higher the initial temperature. Thus a few degrees in the atmospheric temperature may make all the difference as to whether insulation will endure for a very long time or will inevitably fail within, perhaps, an hour, or even a few minutes. The wattmeter shows perfectly what the course of the experiment is likely to be. The effect of dessication in reducing the energy developed is most marked, but all increase in humidity, temperature, or electric stress results in an increase in the rate of heat production, and the temperature may rise till destruction takes place. Even if the insulating material be protected by sheets of mica, which are sufficient to withstand the voltage, destruction by charring may ensue, and the mica may have comparatively little effect on the rate of heat production.

These and previous experiments on micanite show that the heating effect due to brush discharge in air, when the voltages are high and the materials thick, may be very serious.

Among the Contractors.

The Modern Electric Company has been organized recently to do an electrical contracting business at 411 Twenty-third Street, Ogden, Utah.

Davis & Fredericks, 400 East Fifteenth Street, Minneapolis, Minn., have started a contracting business for the installation of electrical plants in the Northwest.

The Lintner Electric Company has bought the electrical contracting business of the Elkhorn Electrical Construction Company, of Fremont, Neb.

The Des Moines Electric Contracting Company, Des Moines, Iowa, has recently begun the installation of electroliers along the main business streets of Quincy, Ill.

The Monarch Electric Company, which does an electrical-contracting business, specializing in repair and power-plant work, has recently moved from 307 East First Street to 306 Eighth Street, Des Moines, Iowa.

The Squire Electric & Construction Company, of Kansas City, Mo., has just secured the contract for wiring the administration building of the Pythian Home at Springfield, Mo.

W. E. Frits has recently acquired the business of the Midland Electric Company, 613 West Grand avenue, Des Moines, Iowa. The company, which is doing a general electrical-contracting and fixture-manufacturing business, will be incorporated in the near future.

The Osborne Electric Company, of Kansas City, Mo., has recently wired the Stock Exchange Building in Kansas City. The Osborne Company, it is interesting to add, is pushing the sale of the electric range now. The agency for a high-grade range has been secured, and the company will devote considerable effort toward promoting its use in Kansas City, and in other neighboring towns as well. H. C. Henrici is the enterprising manager of the Osborne Electric Company.

The Standard Electric Company, of Omaha, of which Edward F. Schurig is president and treasurer, is putting in the electrical work in the new high-school building in Omaha. It is stated that this will be the largest building of its kind in the world. This company is also installing the electric wiring in the buildings of three of the Nebraska State Normal Schools, in those of the State Agricultural School, and in the county court house at Central City, Neb.

O. W. Barger.

The city of Joplin, in the good state of Missouri, affords an excellent example of some of the benefits of co-operation among the different interests in the electrical industry. Although gas for both lighting and power is abundant and cheap, this place is truly an electric city. And that it is such is in no small measure due to the fact that the contractors and the central-station men pull together all the time for everything electrical.

Nearly all of the big things electrical which are being brought to pass in that prosperous community come through the combined efforts of the Empire District Electric Company. and the local firms of electrical contractors. The central-station company does no electric wiring. It maintains a vigorous and energetic new-business department,

O. W. Barger,
President Rex Electrical Supply Company.

but all electrical construction is promptly turned over to the contractors. One of the most successful of these electrical contracting firms is the Rex Electrical Supply Company, and O. W. Barger is its president.

Mr. Barger has been engaged in electrical work for the past twenty years —which means that he began it when he was sixteen years old, for his age is thirty-six. He was born in Lynchburg, Va., but his parents moved to Franklin Falls, N. H., when he was five years old. He was in the employ of the Pendergast Construction Company, of Franklin Falls, for four years, from which position he came to Joplin sixteen years ago. His first work in Missouri was as an electrician and electrical engineer for mine operators around Joplin, and he still holds the position of electrical engineer for the Richer Lead Company, whose headquarters are here.

The Rex Electrical Supply Company was organized three years ago. It gets its name from Rex Camblin, who, under the direction of Mr. Barger, is the young and enterprising secretary and manager of the business. The firm does a general electrical-contracting business and makes a specialty of electrical work in mines. It conducts a large electrical store, where all sorts of electrical supplies are handled.

Licenses for Electricians in Omaha.

The Department of Electricity of the City of Omaha, Neb., has recently created a rule providing for the examination and licensing of electric wiremen in that city. Eletricians who seek employment there must, before beginning work, apply to the City Electrician for a written permit to engage in such occupation. If in the opinion of the City Electrician the applicant is a competent wireman, a temporary permit is granted him, and this is effective until the next meeting of the board of examiners following the issuance of the permit, when an examination to determine his skill held. The fee for a license is one dollar, and there is a renewal charge of 50 cents a year. Waldemar Michaelsen, City Electrician, is chairman of the board of examiners and the other two members are E. C. Bennett and C. E. Dohn. Both Mr. Bennett and Mr. Dohn are engaged in practical electrical construction in Omaha.

The above rule, it should be explained, does not apply to men conducting an electrical-contracting business in the city. These are bonded in accordance with a previously existing city ordinance.

House Wiring in Omaha.

In Omaha nearly 4,000 already-built houses have been wired and connected to the lines of the Omaha Electric Light & Power Company within the last three years. The central station here keeps up an active campaign for the sale of current in houses built without being wired, but, whenever new business is secured, the wiring to be done is turned over to one of the contractors in the city. The central station does no wiring itself.

Diesel to Speak on the Diesel Engine.

The American Society of Mechanical Engineers has decided to honor Rudolph Diesel, the inventor of the Diesel internal-combustion engine, and honorary membership will be conferred upon him on April 30 at a meeting to be held in the Engineering Societies Building, New York City, at 8:15 p. m.

Following this ceremony Dr. Diesel will give an illustrated address under the auspices of the Gas Power Section on "The Development of the Diesel Engine." All who are interested in this subject are invited to be present.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Sparking of Motor Brushes.

During several years of experience with 110-volt direct-current motors, I have encountered considerable trouble with brushes sparking; they would often continue to give trouble after I had applied nearly every known means to overcome it. I discovered that the heat caused the brushes to become very dry after being in use for any great length of time, and decided that they were in need of oil. Where all other conditions were favorable and the brushes persisted in

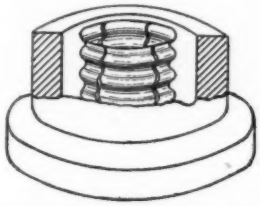


Fig. 1.—Showing Lines Along Which Receptacle is Cut.

sparking, I have found the following to prove successful in every case.

Take a set of brushes and soak them in a good grade of motor oil, for at least 48 hours. Before placing them in the holders, wash them thoroughly in gasoline. The commutator will need a little extra attention for a few hours afterward, as the heat will tend to bring the oil out quite freely for a little while, but this soon ceases and the brushes run noiselessly and without a spark.

The same rule applies equally as well to generator brushes.

W. A. Hines.

A Convenient Device for Testing Incandescent Lamps.

The figure which is shown here illustrates a very simple device for testing incandescent lamps to see whether they are in good operative condition or not. This test has to be made so frequently in a contractor's store that any arrangement for doing it quickly is well worth considering. My plan is simply to take an ordinary receptacle—preferably a No. 9171—remove the sleeve from it, and then slit it as shown. The lamp can be inserted in such a receptacle and removed without the necessity of turning the lamp in and out, which latter process is one that requires considerable time.

Edward F. Conley.

A Quick Test.

When a fuse blows on an ordinary two-wire lighting circuit from a short-circuit or ground remove both fuses from the block or cutout. Instead of a fuse, screw in a 220-volt lamp in each place alternately; if the circuit is grounded, the lamp will light on the wire that is grounded, if all lamps are turned off at the socket. Let the lamp stay lighted until the ground is found, when it will go out.

If the circuit is not grounded, screw in one fuse and a lamp, which will light if the circuit is short-circuited and all lamps turned off. This lamp is a permanent telltale to watch, as it

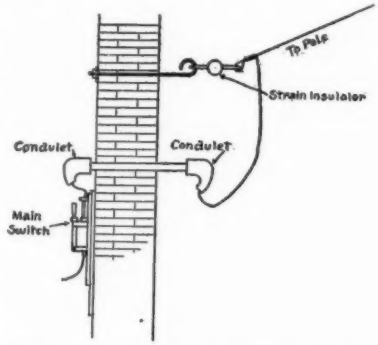


Fig. 2.—Overhead Service Entrance.

goes out immediately when the trouble is cleared. In the case of inclosed fuses, suspend lamp in test socket from fuse terminals.

Charles E. Henney.

Support for Overhead Service Wires on Brick Walls.

In looking around for a satisfactory method of supporting heavy service wires where these must be attached to a brick wall before passing into the building, I hit upon the following, which I have found to work well.

A hook is installed in the wall by drilling and inserting a rod in the manner shown in the diagram, and to this hook a strain insulator is attached for supporting the wire. The wires themselves are taken through the wall in a piece of conduit with a Type B condulet on the inside and a Type F on the outside.

Albert J. Wheaton.

Pulling Wire Into Flexible Tubing.

I have seen wiremen have a great deal of trouble in trying to shove a wire through a long piece of loom. Such trouble is not at all necessary. Whenever I have to cover a long wire with tubing of this sort, I shove a steel fish wire through the loom first and then draw it through with the copper wire attached.

G. Pendleton.

A Substitute Drill for Brick Walls.

When a man is installing conduit in a frame building he often has to drill through just one or two brick walls and finds himself without a suitable drill. Instead of filing teeth in the end of a piece of pipe, simply take the reamer, which is indispensible on any conduit work, and ream the end of the pipe to be used for a drill to a reasonably sharp edge. It will cut brick better than if it had teeth and never tightens in the hole. The time saved in its preparation is very considerable.

C. E. Henney.

Portable Light for Sign Work.

Having been compelled to work at night not long ago in assembling a large electric sign, we cast about for some means of securing a light which could be moved about from place to place and left hanging wherever needed without having to be held in the

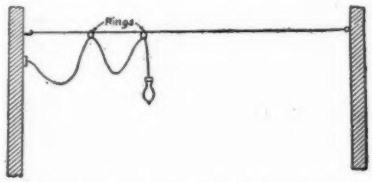


Fig. 3.—Support for Portable Lamp.

hand. We secured the results desired in the manner indicated in the diagram. Over a smooth wire stretched across the room a number of large rings were slipped and the flexible cord feeding the portable lamp was taped to these rings at points along its length. The lamp could easily be slipped along the wire, If metal rings are used, care should be taken to insulate the cord from them, of course.

E. F. Thomas.

Cutting Conduits Straight.

J. C. Green in his description of cutting large conduit straight, which was printed in the April 13 issue, states, "In most of the large cities wiremen are compelled to use a hacksaw in cutting conduit." I see no sense or necessity for such a requirement; if the wiremen will procure pipe cutters with a single cutting wheel and with one or more roller wheels, the conduit may be cut off perfectly square, with no burr on the outside, and only a small burr on the inside that may be readily removed.

William A. Murray.

Among the Supply Men

M. B. Austin & Company, 706 West Jackson Boulevard, Chicago, Ill., reports active business. The company has just secured an order for the Leader Building, Cleveland, O., for 170,000 feet of assorted sizes of Ruby Core wire made by the Safety Insulated Wire & Cable Company. This runs from No. 16 fixture wire to 800,000-circular-mill cable, and the order includes 100,000 feet of No. 14 Duplex. The contract for wiring and electrical construction is held by the Enterprise Electric Construction Company, Cleveland, of which A. L. Oppenheimer is president. M. B. Austin & Company are also general western agents for the Safety-Armorite Conduit Company, and it has recently published a partial list of "Galvaduct" installations. This list is set in ten-point type and is five feet long. Buildings and construction of every character are included, and the installations cover practically every state in the Union, including also the conduit equipment of coastwise, ocean-going and lake steamers, and a number of battleships, cruisers and torpedo boats.

The Adams Electric Company, local dealers in electrical supplies, Trenton, N. J., has been placed in the hands of receivers by Chancellor Walker. Frederick R. Brace has been appointed The application for receiver was made by Carl F. Adams, president and treasurer of the company, who is the owner of $13,389 worth of the capital stock and who claims that the company is not in position to meet its debts, nor has it enough money to continue its business. The total liabilities of the company will reach $24,809, while the assets, which are regarded as problematical, will come to about $24,000.

The Electric Supply Company, Memphis, Tenn., reports an unusual local demand for electrical cooking devices on account of the high water in that part of the country causing a suspension of the gas supply. The company was established in 1897, as an active corporation, and covers the territory of Western and Southern Kentucky, Tennessee, Northern Alabama, Mississippi, Northern Louisiana, Arkansas and Southern Missouri. M. R. Herstein is the active head of the organization.

The Nunn Electric Company of Amarillo, Tex., covers Western Oklahoma, Western Texas and the Eastern half of New Mexico. The company is established as a wholesale business, but carries on a retail fixture department. J. L. Nunn is manager of the company, and is in partnership with J. E. Nunn. The business was established in February, 1909. No special demands are apparent in this part of the country, and the company reports that F. C. Cady, late lamp man for the General Electric Company in Texas, will have charge of its lamp department.

D. C. Penniman, formerly of the Central Electric Company, will have charge of the supply department of the Northern Electrical Company, Duluth, Minn. This company is a corporation covering the Northern half of Minnesota and portions of Northern Wisconsin. James Richardson, of Minneapolis, is the president, and A. W. Lindgren, general manager. The company reports conditions rather quiet at this time, but with very bright prospects. Special campaigns are being conducted on vacuum cleaners and electric washing machines. The company does quite an extensive business in its retail store.

The Mills Electric Company, Peoria, Ill., held a convention of its sales department at the New Jefferson Hotel, on April 6, twelve members of its selling organization being in attendance. The company is reporting good business in Illinois, with considerable activity in construction material because of consolidations and the building of transmission lines in this territory. Special sales campaigns are being conducted on Holophane glass and "Local Option" dry batteries. The active members of the company are LeRoy A. Mills and H. M. Butler. The company was started as a contracting and retail concern in October, 1904, but in August, 1907, became an exclusively wholesale proposition. The company does no retail business whatever. The territory covered is Indiana, Illinois, Iowa, western Kentucky, northern Missouri and southern Wisconsin.

C. M. Maxwell, recently with the Colonial Lamp Company, is now traveling southern Pennsylvania and Maryland lamp territory for the J. H. Waugh Company, Pittsburgh, Pa. This company covers a territory extending over Pennsylvania, west of Harrisburg, Maryland west of Hagerstown, West Virginia and Ohio. The name of this company is to be changed to the Electric Sales Company, and under the management of a prominent supply man. Mr. Waugh will devote all of his time to the Eastern Electric Lamp Company.

The Robertson-Cataract Company, Buffalo, N. Y., reports business fairly quiet at present. This company does a big retail business amounting to something like $200,000 annually. This is a feature and a distinct department of the company's work. The company was organized March 1, 1902, and covers a territory extending from the Vermont state line west to Cleveland and south to central Pennsylvania. Sales conventions are held four or five times a year, the last one being held on April 5 and 6. The officers are James D. Robertson, president; W. R. Huntley, vice-president; C. S. Sidway, treasurer; R. H. Sidway, secretary; W. E. Robertson, general manager.

By the reorganization and enlargement of the Johnston Electric Company, 411-13 South Tenth Street, Omaha, Neb., into the Midwest Electric Company, just announced, Omaha secures one of the largest electrical supply houses west of Chicago.

George A. Seabury will be the secretary and general manager of the new concern. He has for several years been connected with the General Electrical Company, the last few years as manager of the Kansas City branch. H. J. Coleman is added to the force in the capacity of illuminating engineer, and Ned McCue is an addition to the sales force.

George W. Johnston, the founder of the late company, and for twenty-five years in the electrical supply business in Omaha, remains with the new company as its president. Mr. Johnston several years ago founded the Western Electrical Company, the name of which was changed five years ago to the Johnston Electrical Company.

Legal Notes

RIGHT OF ELECTRIC COMPANY TO CONSTRUCT SUBWAYS FOR CONDUITS IN STREETS.

By Maguire and Mooney.

Rights to construct subways for underground conduit must exist in the charter or franchise or be granted by ordinance or other legislative enactment. Certain states specify that all wires shall be underground; others leave the choice to the operating company. Where not thus specified by the state, local ordinances govern and their provisions must be followed.

The construction of conduits for the purpose of laying electric wires underground has been founded upon necessity, and inasmuch as a great deal of such work is now being done and a greater part will be done in the near future, it is necessary to understand the rights of companies to construct such systems, and if they have such a right, then the manner in which they may be maintained.

There are several advantages in the placing of electric wires underground. The wires, when placed underground in a proper manner, can cause very little injury to anyone. They are not accessible, nor exposed, and probably the only way injury might result to anyone would arise from such an improper construction that the current would escape to the street above. Electrolysis would also have to be garded against.

According to the rules set forth in a previous article, a public-service company may be prohibited from erecting its poles and wires in public highways even when permission is granted by the proper authority, unless compensation is made to the owners of the abutting land. But no compensation need be given to the land owners in laying conduits. No damage of any kind can result to his property, his view is not impeded, and he is not endangered by a multitude of electric wires. One of the principal objections to the erection of poles in public streets is that it was the intention of the public, when the streets were dedicated, that they would be used for ordinary travel, and that nothing was intended to remain as an obstruction. In the placing of conduits beneath the surface of the street such an objection as this is out of place. In fact, conduits might almost be considered as necessary to the conduct of modern business as sewer pipes are for sanitation.

The charter of the electric company is the basis for determining whether they may construct subways for the reception of conduits or not. Of course, if the charter does not give the company such power, directly or indirectly, then it has not the power to construct conduits. Generally speaking, the charter power to lay wires "over and through" the streets of a city does not of itself include permission to lay them underground. The legal construction of such words could not mean this.

While only a few cases have arisen on this subject, nevertheless, the rules therein laid down have been produced by such good reasoning that it is entirely probable they will be the rules in all cases arising hereafter.

In some of the large cities of this country the large department stores have obtained from the city the right to use a certain space under the sidewalk. The sidewalk space belongs to the city, and if it has a right to authorize its use by stores, it may authorize electric companies to string their wires along beneath the sidewalk. In the case of Allegheny County Light Company vs. Booth, 216 Pa., 564, Booth has interfered with the company's installation of a conduit system. The charter of the company authorized it to erect and maintain poles and wires for the purpose of conducting electricity; and by an ordinance it was authorized to supply light, heat and power, and in distributing its electric current for such purposes it was granted the right to enter upon any street, alley or highway. The company was placing its conduit beneath the sidewalk and the court held that the right given to the company to enter upon streets was a right of eminent domain, and that, inasmuch as the sidewalks are parts of the streets, the company could install its system beneath the sidewalks. The city should have the same control over its sidewalks as it has over the roadways themselves.

But, in seeking to place conduit beneath sidewalks private property should not be entered upon. In Lent vs. Tilyou, 94 N. Y. Supp., 479, Tilyou operated an electric lighting company and Lent was a prospective customer. In order to furnish light to Lent and to other customers who might apply, the company sought to lay down conduits and tubes in certain ways, known as the Bowery, Tilyou's walk and Kensington walk. Lent leased premises that abutted on the Bowery and had made and maintained walks over private property, part of which had been leased to various persons for places of amusement, but a large part had been kept and maintained by Lent for like purposes. The public had used these walks for access to these various places of amusement for about thirteen years, but no one had ever asserted any authority over them except Lent, who paid for all improvements put in on such property. When the company sought to place its conduits in these walks Lent refused permission and they then sought to restrain him from interference. The court held that an electric company could not extend its conduits and tubes through private walks which have never been acquired by the city for street purposes, solely by reason of the fact that the public uses such walks for access to places of amusement.

When a company determines that it has a right to lay its wires under ground it must consider the method of such construction. In State of Missouri vs. Murphy, 130 Mo., 10, the Laclede Gaslight Company had the right to light the city of St. Louis, and was authorized to lay down all pipes and fixtures properly required. Murphy was the street commissioner of St. Louis. The company desired to make an excavation along the east side of Broadway as near the curb as practicable, extending from Mound Street to Olive Street, such excavation to be for the purpose of laying electric wires underground. Murphy refused to issue the necessary permit until the company had complied with the municipal ordinances. The company claimed that its franchise permitted

it to lay its wires underground, and for that reason it should be permitted to lay them as it saw fit, and that municipal ordinances should not restrict it. The court, in deciding the case, held that, inasmuch as electric wires, when charged, are dangerous to life and property, their use should be subjected to proper police regulations. Accordingly the regulations of the city regarding the kind of conduit and the method of construction were held to be reasonable, and it could, subject to such regulations, place its wires underground. The necessity of having regulations of this kind is to prevent one company from pre-empting a street and so manipulating matters that other companies could not lay their wires there. If there was no authority in the city to regulate gas companies, water companies and other companies engaged in public service would be prevented or hindered in their work. The city might even be prevented from laying permanent pavement, or the street-car companies from operating their cars, if companies would not conform to regulations regarding electrolysis. For instance, the municipality can designate the proper place for the location of the trench, such as locating it inside or outside the curb, or any other place in the street; it can require a certain quality of conduit, and may require the company to give bond to cover the faithful performance of the work.

However, the proper authorities may sometimes refuse to permit an electric company to occupy a certain street on account of the narrowness of the street, or for other reasons. This rule is more applicable to the erection of poles than to the construction of underground systems, but the proper authorities undoubtedly have the right to forbid a company laying down its system when the street is already full of other pipes and conduits.

The states of Indiana, Kansas, Michigan, Mississippi, Missouri, New Hampshire, New Jersey and New York permit the electric companies to elect whether they will construct conduit systems, or use the old method of poles and wires, but the states of Maryland, Massachusetts, Ohio and Vermont require all wires to be laid underground.

The necessity of these laws arose out of a great evil which has grown up and afflicted large cities by the multiplication of rival and competing companies organized for the purpose of distributing light, heat and water, and for the transportation of freight and passengers, and these enterprises not only required the occupation of the surface and air above ground, but indefinite space underground. Every large city would, in a short time, be covered with a network of cables and wires attached to poles, houses and buildings that would bring danger, inconvenience and annoyance to the public. Extensive spaces underground were also required to lay pipes and build trenches and arches, in order to transact the business of the various corporations requiring the distribution of current. Municipal ordinances, in states which have not adopted the foregoing rules, control these questions, and are just as binding as a state law.

Great skill was necessary to harmonize the various and conflicting claims of competing companies to rights above as well as below the ground, and a comprehensive plan, to prevent constant disruption of the streets and the interruption of traffic, had long been needed. This was solved by the organization of subway companies. A subway company does not itself distribute electric current but it rents space to those companies that do distribute electric current. In some states there are general subway corporations franchised to build subways under city streets for the use of electric companies that desire to so use them. These subway companies are common carriers, that is, on obtaining a franchise to operate, they must treat all companies alike and must give special privileges to none. They are franchised for the benefit of the public, and if they refuse to permit an electric company to put its wires through, upon paying or tendering reasonable compensation therefor, they become merely a private corporation and are liable to the forfeiture of their franchises and privileges. In New York, for instance, the laws provide for the appointment of subway commissions, and these commissioners have full charge of the regulation of subways with the power also of compelling all companies operating electric lines to use the subways. The subway companies charge a rental for the use of the space, and unless they were regulated they would take advantage of this, and raise the rental to some companies and lower it to others so that it would not be fair.

The difficulty in some states is in the determination as to whether such subway companies are public or private corporations. If they are private corporations they may choose their customers and may permit only such wires as they see fit to go in their subway, but no private corporation can obtain franchises or the use of public streets unless it agrees to treat all alike and accept the business of all. Thus authority was granted to the National Subway Company of Missouri to operate a subway system for the conveyance of current, subject to the supervision of the Board of Public Improvements. This authority did not indicate that it was anything more than a private enterprise, inasmuch as it was not required to rent space to all companies upon equal terms. Therefore, the court held the city had no right to grant it any rights in the city streets, and declared the franchise void.—State of Missouri ex rel. St. Louis Underground Service Company vs. Murphy, 34 L. R. A., 369.

Wireless Installations

A law has been promulgated by the President of Uruguay making wireless installations on passenger vessels touching at Uruguayan ports obligatory on and after May 1, 1912. The installations must be such as to enable the receipt and transmission of messages from or to a distance of not less than 100 kilometers on vessels used in river navigation, and 400 kilometers on ocean-going vessels and the installations must be permanently kept in condition to communicate with Uruguayan wireless stations,. Vessels not complying with the law will not be allowed to engage in the passenger traffic in Uruguay. The central wireless station at Cerritos in the suburbs of Montevideo has been opened to public service, and the private wireless telegraph stations throughout the Republic have been discontinued since January 24 last.

Wireless Development for Aeroplanes.

In some recent experiments in England a British military scout was able to carry on a regular exchange of messages by means of wireless telegraph upon an aeroplane several miles from his base. It is expected that this distance can be greatly extended. The great problem has been to design an apparatus for transmitting signals sufficiently light to carry on an aeroplane. The receiving apparatus gives no difficulty. The wireless operator was a passenger on the aeroplane, and the messages sent by him transmitting his observations were received very clearly.

Power Sites Reserved.

Acting on data furnished by field men, the United States Geological Survey took action in March leading to the creation of water-power-site reserves in Arizona, Colorado, New Mexico, Utah and Washington aggregating 24,091 acres. The reservations are believed to contain many favorable power sites. Restorations of more than 10,000 acres of land previously withdrawn in connection with power sites were made during the month in Colorado, Idaho and Washington.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 61.—Opening Exposition from a Long Distance.—After reading that a prominent man had started the wheels of an exposition by pressing a button over 1,400 miles away, I had a dispute with a man who asserted these stories are pure fakes, that he did not believe it was possible and knew at least one case where merely a telegraphic signal to the operator in a substation had been sent. I contended that a telegraph relay can easily be arranged to control the necessary switches. Was I right?—H. B. D., Faribault, Minn.

No. 62.—Searchlights as Aids to Navigation.—In view of the great interest in marine affairs aroused by the disaster to the *Titanic*, I take the liberty of asking the following questions: Is there anything in the argument that the use of a searchlight on a steamer prevents the lookout from seeing the lights of a distant vessel? How far may the beam of a reasonably powerful searchlight be seen on a clear night? On a foggy night? Would not an iceberg loom up very conspicuously at a distance of several miles even on a fairly clear night? What is the power consumption of searchlights such as are used on battleships and large excursion steamers?—J. S. N., Muskegon, Mich.

No. 63.—Value of Commutator Slotting.—I should like to know whether any of your readers have had experience with slotted commutators on motors exposed to oil, dust or dirt.—R. M., Austin, Tex.

No. 64.—Effect of Sagging Tungsten Filament.—If a wire-type tungsten lamp is hung at an angle so that the filament sags after being heated, does the permanent set thereby produced render the filament more fragile than if it had been hung vertical?—P. H. E., Dixon, Ill.

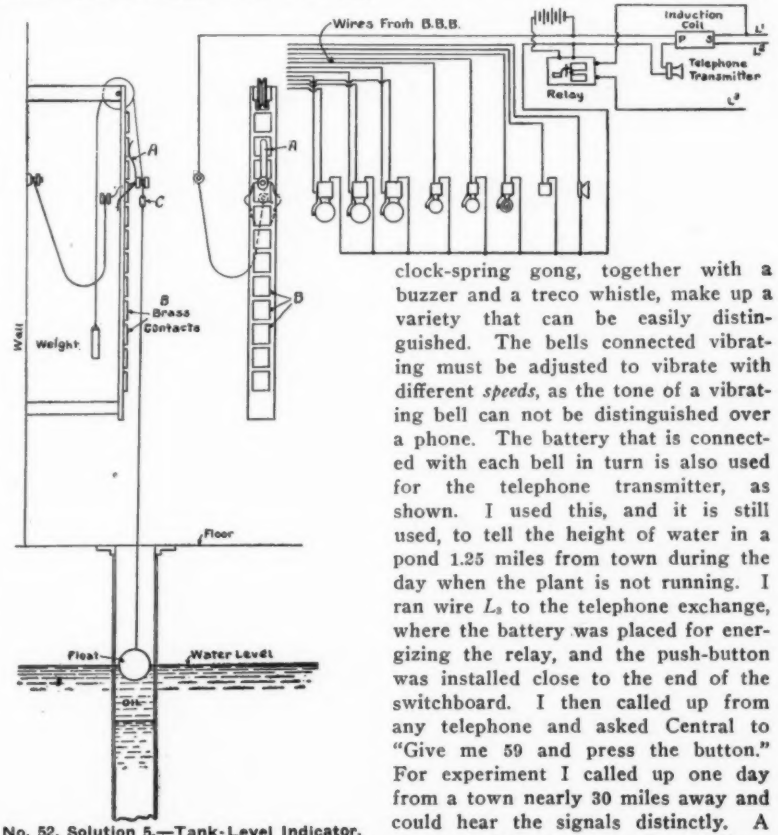
No. 65.—Electrolytic Rectifier. — I would like to build an electrolytic rectifier to use on a 110-volt 60-cycle circuit and to carry about five amperes. What kind and size of plate are best for this purpose? What solution should be used?—A. F. K., Louisville, Ky.

Answers.

No. 52.—Electric Level Indicator for Tanks.—Is there an electrical device for indicating at a remote point the varying height of water in a ten-foot tank?—J. A. S., Montreal, Canada.

[Four answers to this question were published on pages 620 and 621 in the issue of March 30, 1912, and on pages 711 and 712 in the issue of April 13, 1912.—Ed.]

Solution 5.—The diagram of a scheme for indicating at a remote point the height of water in a tank published in your issue of March 30 had the drawback of requiring too many wires between the tank and the place where the readings were to be taken. The scheme which I have had in use for several years at Bellaire, Mich., requires but three wires—the regular telephone line forming two of them. One additional wire is all that is required. A board three inches wide and three feet long will answer for keeping track of water level through a range of two feet with 13 readings, or the board can be made any length with the brass strips longer than two inches. A sliding contact *A* slides up and down the board, with wire guides to keep it from slipping sideways. One of these extends to the back of the board and has a piece of flexible cord attached for one of the connections. From each of the brass strips a wire goes to an electric bell or a buzzer or a treco whistle. As the water rises and falls finger *A* makes contact for the different bells. The telephone wires, or special wires strung on purpose, L_1 and L_2, are connected to the secondary of an induction coil. A third wire, L_3, goes to one binding-post of a 20-ohm telegraph relay, as does also one of the other two wires. A battery of two or three cells at the place where readings are taken, cut in by a common push-button on wires L_1 and L_3, rings whichever bell is connected by contact finger *A*, and by listening on the telephone a person can tell with a little practice which bell is rung. The three larger bells are connected vibrating for three readings, and also single-stroke for three more readings. Then other different sounding bells, one being a clock-spring gong, together with a buzzer and a treco whistle, make up a variety that can be easily distinguished. The bells connected vibrating must be adjusted to vibrate with different *speeds*, as the tone of a vibrating bell can not be distinguished over a phone. The battery that is connected with each bell in turn is also used for the telephone transmitter, as shown. I used this, and it is still used, to tell the height of water in a pond 1.25 miles from town during the day when the plant is not running. I ran wire L_3 to the telephone exchange, where the battery was placed for energizing the relay, and the push-button was installed close to the end of the switchboard. I then called up from any telephone and asked Central to "Give me 59 and press the button." For experiment I called up one day from a town nearly 30 miles away and could hear the signals distinctly. A piece of fiber *C* keeps the telephone line from being grounded through the float. The float rides in a pipe open at the bottom and containing a gallon of oil so it is not made inoperative by ice forming in winter.—C. W. Goddard, Muskegon, Mich.



No. 52, Solution 5.—Tank-Level Indicator.

No. 57.—Operation of Moving-Picture Machines.—I understand that moving-picture machines are always run by hand and that motor drive is not permitted. Why is this? Would not a motor drive give a much more uniform speed and therefore produce a more regular and pleasing show?—H. V. N., Columbus, Ohio.

Motor-driven moving-picture machines

will undoubtedly give a more even picture production, but the possibility of ignition of the inflammable film and the consequent life hazard is guarded against to a certain extent by the presence of the operator, as he has to be in the booth whenever the hand-operated type is used. It would be only natural that the operator would seek a more comfortable place than the crowded and warm booth and especially so in warm weather, if the machine were automatically operated. His constant attention is necessary on account of the frequent occurrence of rapidly spreading fires caused by the sudden blazing up of the film. Hand chemicals are generally required by the insurance interests and these would be of little use were the operator elsewhere than right "on the job." —H. G. W., Chicago.

A moving picture projected by a motor-driven machine is more pleasing to the eye, owing to the steady and constant speed maintained, thus giving a more natural movement to the object projected. In operating by hand, it is only natural that the downward motion of the crank will be more determined than the upward one, thus giving a more or less jerky effect to the object on the screen. If the machine is not securely fastened to the floor of the booth, this will be perceptible on the screen by the movement of the whole picture from one side of the screen to the other. It is evident, therefore, that a motor-driven machine gives better results. The reason for the same not being permitted is that the operator is not always at his machine unless he is operating by hand. We know that a picture film is highly inflammable and that if it should remain stationary in the concentrated rays of the projecting light for a period of about four seconds a fire would result. I, for one, would prefer to operate a motor-driven machine, as in case of trouble I would have two hands to work with instead of keeping one turning the crank. If a fire should start on the hand-driven device, how many operators wouldn't leave go of the crank in the first stage of excitement and leave the switch on? I believe there is no other reason than the above stated for not permitting motors on moving-picture machines.—Operator, Cleveland, Ohio.

Motor operation of moving-picture machines is prohibited in some parts of the country because of the added fire risk. The uniform speed of operation of a motor-driven machine is better as far as certain results are concerned, because the eye-strain is less than when the flicker is increased and decreased with hand operation. To my mind the fire risk is equal in both cases, as I will presently show. I put my head out through the peep hole to talk to a friend—the film breaks and runs 150 feet or more of film out on the floor or lamp—the picture gets brown on the bottom—the light flames up and goes out —the motor goes merrily on with its work, etc. All of this could happen just as easily if I had my head out of the peep hole talking to my friend and kept on automatically turning the crank. The law is the cause of a lot of hand driving of motion-picture machines, but it can't make an operator attend to his business. If he is careful the motor drive is all right; if he isn't, he had better get out of the business before he kills someone.—H. M., Hutchinson, Kans.

The primary reason that motor drive is not permitted is that, in case the film breaks, the machine would continue to run, bringing more and more film into exposure with the light or even into direct contact with the hot lamp casing, thus greatly increasing the fire risk. Of course, this would not be true if the operator would immediately stop the motor, but the tendency is for the operator to pay less attention to the machine when his own presence is not essential to its operation. A number of fires have been caused by machines which were motor-driven, in one case the operator being not in the operating booth when the film broke and caught fire. In general, the ruling is effectual in that it calls for the constant supervision of the machine while in operation.—J. B. W., Ann Arbor, Mich.

No. 58.—Series Circuits for Ornamental Street Lighting.—Why are most installations of ornamental street lighting with tungsten clusters made on multiple circuits, whereas all other street lighting is almost invariably on series circuits? I should think that series tungsten lamps would give better results than multiple lamps and circuit control would be much simpler.—P. R. J., Evansville, Ind.

The reason that ornamental electroliers and standards for street lighting are usually wired with multiple lamps on low-voltage circuits is because of the difficulty in insulating the wires and lamp sockets in the metal electroliers. There is a system on the market where a series transformer is installed in the manhole or base of the standard, the secondaries of which supply that standard alone. There is one of these transformers for each standard. The primaries of these transformers are connected in series, consequently the voltage of the line is the voltage of the transformer primary times the number of transformers or standards installed.—C. T. P., San Francisco, Cal.

The reason why most installations of ornamental street lighting are wired with multiple circuits is to keep down the voltage. As the tub regulator is usually run on high voltage, this is not desirable in cluster lighting. There is no doubt that series lighting is simpler and more easily controlled. With the Pittsburgh series system the voltage can be kept at a low value, thus eliminating the principal objection to series lighting in this work. This system has been developed to fulfill just such conditions. The transformer coils which provide the regulation and give absolute reliability of service are mounted in a sheet-steel case, which is filled with a waterproof compound, making the coils absolutely impervious to water, thus permitting them to be mounted in the base of the standard for ornamental lighting systems. The voltage of the system can be kept very low, which is the great distinguishing point as compared with the film socket. The latter will not puncture on voltages lower than 1,000 and such voltage is not desirable for ornamental-standard lighting. Furthermore, even at 1,000 volts the film socket is far from reliable and it would be fatal to the ordinary lighting system for the whole line to go out and cause great difficulty in locating a lamp which had burned out and whose film socket had not operated. Another great advantage in the system is that on a five-light standard, for instance, two series circuits can be installed, both of comparatively low voltage, and part of the lights turned off at midnight while the remaining lights continued for the entire night. This would be undesirable on any other system of series control. The efficiency and power-factor in the Pittsburgh system are very high and the regulation practically perfect.—R. V. B., Pittsburgh, Pa.

No. 60.—Effect of Wave-Length on Wireless Service.—What is the effect of wave-length on the relative distances that wireless messages can be sent by day and by night?—M. S. V., Ann Arbor, Mich.

The different relative distance that wireless messages may be sent at different wave-lengths is due to atmospheric absorption. The cause of atmospheric absorption is not fully understood as yet, but it may be due to a dissipation of energy from the wave-front in the higher altitudes of the atmosphere, which becomes ionized and hence partially conducting by sunlight. If there were no absorption, one wave-length would probably be as efficient as another in wireless work. From experiments it has been shown that such absorption is much less for long wave-lengths than for shorter ones; thus for great distances it is better to use a long wave-length. For transatlantic work a length of 7,000 to 8,000 meters is in use at the present time. At night the absorption, on the average, is much less than by day, but it varies so very rapidly, and within such very wide limits that no wave-length now in use will, by any means, give unvarying strength of signals at the receiving station. In Reprint No. 159 from the *Bulletin* of the Bureau of Standards, L. W. Austin gives some very interesting data of experiments in long-distance wireless by day and by night, and with different wave-lengths, showing very conclusively the advantages of a long wave for great distances.—B. L. D., Arlington, Mass.

Nebraska Electrical Association.

Fifth Annual Convention, Omaha, April 16, 17 and 18.

The fifth annual meeting of the Nebraska Electrical Association, which, has become the Nebraska State Branch of the National Electric Light Association, took place at Omaha last week. The first of the meetings was held on Tuesday morning, April 16, and consisted of a formal address of welcome by Mayor James C. Dahlman, of Omaha, and an appropriate response by H. A. Holdrege, president of the Association. The first of a very interesting series of technical papers was read by H. O. Hampson, of Omaha, whose subject and the substance of whose remarks follow.

Meter Testing.

It was explained that as the period of service grows longer the watthour meter tends to run slow rather than too fast. The central station must either test its meters regularly and readjust them for correct registration, or else, in order not to lose money, it must charge a higher rate for current than would otherwise be necessary. The accuracy of registration of a meter depends in a large measure upon whether its capacity is suited to the load. The light-load errors of a meter are by far the greatest, and so it is better to allow a meter to run on 50 or even 100 per cent overload occasionally rather than use one whose average load is only a small fraction of its rated capacity. In other words, it is bad practice to select a meter of such a size that most of the time it will be running on a load which is only a small fraction of the maximum load it was designed to carry.

In residence service it is good practice to install a meter whose rated capacity is from 25 to 50 per cent of the connected load, but in no case should a meter of smaller capacity than 500 watts be used. For metering a single motor, the meter and motor may be of the same rating; but in choosing a meter for several motors the probable usual load conditions of the motors must be carefully taken into account.

It was pointed out that there are two types of watthour meters in general use now, these being the commutator type and the induction type. It is not best to use the former type on an alternating-current circuit. The induction meter is simpler and less liable to errors in the readings arising from friction.

Meters, it was stated, sometimes run fast. This may be caused by short-circuits or by heavy rushes of current through the field coils, such as sometimes result from the quick starting or sudden reversing of motors. These heavy rushes tend to weaken the brake magnets.

There are two methods of testing meters in general use. In one of these indicating instruments and a stop watch are used, while in the other a rotating standard is employed. The latter is the simpler and the more generally used. In the latter method, no attention need be paid to fluctuations in voltage and one man can therefore run the test on a given instrument.

The Omaha Electric Light & Power Company tests all meters used on its lines before they are installed, and has been making yearly tests on them after their installation. Rotating standards are used in these tests and the standards themselves are checked up each week with the best of indicating instruments. Every few months some of these indicating instruments are sent back to the factory for re-calibration.

For obtaining testing loads for 110-volt meters of 25 amperes capacity or less, portable resistance boxes are used. In testing larger alternating-current meters designed for voltages not exceeding 440, the Blakeslee "phantom" load is employed, which device consists of a transformer supplying a low-voltage current which can be varied from zero to 150 amperes. For testing loads on direct-current meters, the meter department is provided with several Edison storage cells. One of these short-circuited through the meter and standard will give a current up to 100 amperes. Smaller currents are obtained by means of a carbon rheostat. Meters are tested on full load, half load and light load. Five per cent of the rated capacity is considered light load for alternating-current meters, while ten per cent is taken for direct-current instruments. In order to discover how it has been operating, the first test of a meter is made without disturbing it. Meters are considered satisfactory if they register within two per cent of the correct value.

At the beginning of this year a system of classifying meters as Class A, Class B, etc., was adopted, the classification being determined by the energy registered per month. Hereafter Class A meters will be tested every month, Class B every two months, and so on. On lighting circuits, a meter that indicates a power consumption of 10,000 kilowatt-hours per month, or more, is grouped in Class A, while on power service the lower limit for this class is 5,000 kilowatt-hours.

The paper also described methods of making adjustments on meters that do not register correctly. Moreover, Mr. Hampson, who is the meter specialist of the Omaha Company, showed a number of meters and standards connected up for testing, and distributed some of the cards used in keeping records of tests.

Resuscitation After Electric Shock.

Robert R. Hollister, of Omaha, delivered an interesting talk relating to the care of persons injured by electric shock. He did not favor the older practices in this matter. He explained that the shock may result in temporary paralysis of the respiratory muscles and that the proper thing to do is to endeavor to restore respiration. The patient should be laid prostrate with the face downward. He should then be grasped in the neighborhood of the floating ribs and pressure inward and downward should be applied and released at short intervals, so as to cause this part of the body to move as in natural breathing. An advantage of this method is that it can be carried out by one man.

Street Lighting with Flaming Arcs.

A paper on this subject was presented by F. R. Starr, of Council Bluffs, Ia. Mr. Starr's paper dealt principally with an installation of 500-watt flame arc lamps now in service in lighting the streets of his city. It was explained that the total cost of maintenance, including cost of carbons and trimming, had been found to be about $1.54 per lamp per month of 304 hours' burning. This sum, however, did not include the cost of current, of which the consumption per lamp per month was 152 kilowatt-hours.

The speaker explained that different kinds of carbons may be used in one of these lamps to produce different colored rays of light. In Council Bluffs, yellow rays are preferred.

In the business districts of the city the lamps are mounted on iron poles; elsewhere center suspension over the intersections of streets is employed. The iron poles cost $50 apiece. The arcs are hung approximately 23 feet above the street surface.

Mr. Starr is a strong advocate of the use of the flame arc in street lighting.

Industrial Power.

W. T. Dean, of Chicago, read the first paper of the second day of the

convention, and "Industrial Power" was his subject. He showed lantern slides illustrating many applications of the electric motor of special interest and value to central-station men. The use of the motor in the steel mill, in the wood-working plant, in the railroad shop, in the brewery, on the farm, in the ice-making plant and in various other industrial enterprises was illustrated and discussed.

Mr. Dean's illustrations included lantern slides of a great variety of capacities and types of motors, ranging from the small machine employed in domestic service to the 4,500-horsepower unit used in steel mills and other heavy work. He emphasized especially the use of electricity in agriculture, stating that the question was now largely one of finding economical methods of transmitting power from the central station to the farm and distributing it on the farm efficiently.

Public Policy.

Charles E. Smith, of Exeter, Neb., addressed the convention on the proper attitude of the public utility company toward the public itself. Mr. Smith is a senator in the Nebraska Legislature, and is the manager of the central station in his town. He is thus in a position to speak with unusual authority on the matters which he undertook to discuss before the convention. His address was a very practical talk, full of helpful suggestions to the central-station operator. He said that where there is only one central station in a town or city the public is very frequently disposed to regard this as a monopoly and to assume an improper attitude toward it. This feeling, he argued, can best be combated by frankness and patience with the public on the part of central-station representatives. He said that the central station can never afford to be careless about cultivating and promoting goodwill. Mr. Smith declared that he could injure the business of his own plant very seriously simply by sending out meter readers who would enter a residence without first cleaning the mud from their shoes. He said he had found it a good plan, in some cases, to explain, in a simple way, the operation of the watt-hour meter to the customer. The explanation always included having the customer note the change in the speed of the rotating member as lights were switched on and off. In this way the customer could be convinced, as a rule, that the meter registration was proportional to the load and its duration, and was not an unreliable quantity.

The speaker related an interesting experience of his in which a patron had refused to pay a bill for service which he thought had not been rendered. A building to which the central-station service was connected was unoccupied for an interval of a month or so, and during this period the lights had only been used a very little, and then by workmen. The owner thought that a bill from the lighting company for its minimum charge was unfair. Mr. Smith, without any show of ill feeling, asked the customer to consider an analogous case. "Suppose," said Mr. Smith to this consumer, "that the operator of an automobile garage was required to keep a car and its driver ready all the time for the use of some particular individual, and assume that for a week, say, the car was not used at all. Do you think there should be no charge for keeping the car and driver in readiness during this time?" The customer saw the point and paid the bill.

Mr. Smith cautioned the central-station men present that the vote of the small consumer may count just as much in the matter of establishing municipal ownership as that of the largest property owner. He also emphasized the fact that money used in promoting good will is spent far more wisely than funds invested in lobbying at legislative sessions.

H. A. Holdrege,
Re-elected to Presidency.

Outdoor Substations.

A paper on this subject, prepared by S. Q. Hayes, of Pittsburgh, was read, in the absence of the author, by F. Ribel, Jr.

The paper, which was fully illustrated by means of lantern slides, dealt in detail with high-pressure apparatus designed for outdoor use on transmission lines. Transformers, oil switches, lightning arresters and fuses were shown and described. There were slides, also, of a number of interesting installations where this apparatus is now in service. The Southern Power Company, for example, has several substations on its lines which are not protected by any building.

The advantages of this sort of construction are low first cost and a reduction of the fire hazard. The disadvantages were stated to be the possible danger of such plants to ignorant persons, and the fact that with such construction as this the bad effects of the weather cannot be entirely eliminated.

Safe Electric Wiring.

This paper was prepared and read by Waldemar Michaelsen, City Electrician of Omaha. The paper, which elicited an unusual amount of discussion, is printed in full in another section of this issue.

In the discussion of Mr. Michaelsen's paper W. P. Byron, F. H. Wheeler, G. A. Umbach and J. E. Latta took part. Mr. Byron insisted on being told what the central-station operator should do when the business of the customer can only be secured by giving him cheap wiring. Mr. Michaelsen answered that the central-station man should let such business go; that is, unless the prospect can be convinced by reasonable argument of the folly of putting in poor wiring, which, Mr. Michaelsen thought, could often be done. He thought, moreover, that when the public saw that the central station preferred to lose business rather than permit improper wiring, the result would be more and better business, rather than any loss of revenue.

Mr. Wheeler stated that he was heartily in favor of electrical inspection, but that he did not like the type of inspector that is sometimes employed. In his own town the inspector had formerly been a fireman, and was a man who knew very little about electricity.

Display Lighting.

There were two papers on the subject of display lighting. The first was by J. E. Schuff, of Lincoln, Neb., whose remarks were confined to outline lighting, and the second was presented by W. S. Byrne, of Omaha, who discussed sign lighting.

Mr. Schuff spoke in a general way of the attractiveness of light, stating that, in this particular, human beings are somewhat in the same class as moths. He stated that the crowd always follows the light and that outline lighting is one of the most effective means of attracting attention.

Mr. Byrne, who is power sales specialist for the Omaha Electric Light & Power Company, said that in pushing the sign business his company tried to convince the merchant of the advertising value of the sign, and never presented the matter as a proposition in lighting. He said that an important consideration to the central station is that the sign business may be used to extend the peak load of the evening—that is, to make its duration longer. The Omaha company furnishes power

to signs on a flat-rate basis, it being contracted that each sign shall operate from dusk until midnight. The company had found that the income from the sale of current to say a one-kilowatt sign was about twice that realized from a residence having a connected load of this size.

Recent Developments in Incandescent Lamps.

Evan J. Edwards, of Cleveland, Ohio, read a paper dealing in detail with the latest developments in the manufacture and use of the electric incandescent lamp. The operating characteristics of the carbon-filament, the Gem, the tantalum and the tungsten lamps were pointed out, and the relative advantages of each of these types considered. The lamps were treated from the standpoints of efficiency, life, steadiness of light and color of light. Mr. Edwards contended that, in view of the higher efficiencies, longer life and better color values of the Gem and the metal-filament lamps, it was not generally desirable to use lamps of the old carbon-filament type. He thought, in fact, that the Gem lamp would soon be largely displaced by the tungsten unit.

The paper was illustrated with stereopticon views. There were curves showing how the resistances of the filaments of the types of lamps mentioned above varies with a change in temperature, and the relation of voltage to candlepower in the different lamps; and also micro-photographs of tungsten filaments, both new and after periods of service of various durations. By means of photographs, Mr. Edwards also explained some of the more interesting processes in the manufacture and testing of incandescent lamps.

Unity Power-Factor Single-Phase Motor.

J. A. Gelzer, of Kansas City, read a paper prepared by F. N. Jewett which described a new type of single-phase motor. This machine has two windings on the rotor, one of which is connected to a commutator. There is also an auxiliary winding in the stator which is so placed as to affect the distribution of magnetism in such a way that the power-factor of the machine is caused to be particularly good on all loads. The motor is self-starting and will carry at full speed any load it will start. It is intended to combine the starting characteristics of motors of the commutator type with the full-speed characteristics of the squirrel-cage motor.

Sons of Jove at the Convention.

On Wednesday evening, April 17, there was a banquet at the Loyal Hotel, the convention headquarters, for local and visiting members of the order of the Sons of Jove, of which the initiates at the Rejuvenation exercises following the dinner also partook. C. R. Baldwin was the toastmaster, and J. D. A. Cross, Waldemar Michaelsen, H. P. Kerr, B. McInnerny, Albert A. Guardia and others responded to appropriate toasts.

The Rejuvenation took place in the lodge room of the Elks and there were 17 initiates.

Other Convention Notes.

The social features of the meeting under consideration, other than those already enumerated, included a dinner to member companies of the Association; visits to the power plants of the Omaha Electric Light & Power Company, the Omaha and Council Bluffs Street Railway Company, and to the substation of the Citizens' Gas & Electric Company of Council Bluffs; and also a luncheon at the Omaha Electric Club. Special cars for the trips mentioned were provided by the Omaha & Council Bluffs Street Railway Company.

The report of the Nominating Committee, which was presented at the close of the convention, recommended the re-election of all the officers who had been serving the Association during the past year, and this recommendation was unanimously adopted. These officers are: H. A. Holdrege, of Omaha, president; F. H. Brooks, of Lincoln, vice-president; and J. S. Bell, of David City, secretary and treasurer. The executive committee consists of L. J. Schwingel, of Holdrege; J. E. Schuff, of Lincoln; and Charles Smith, of Exeter.

The place and exact date of the next annual convention of the Association will be arranged by the executive committee.

The Progress of Wireless Telegraphy.

One of the most successful meetings of the New York Electrical Society was its 310th meeting held in New York, April 17, at which Guglielmo Marconi was the speaker. This was Mr. Marconi's first lecture before an American audience and over 1,150 members and guests were present. John Bottomley, president of the Society, presided.

The subject of the address was "The Progress of Wireless Telegraphy," and Mr. Marconi reviewed the development of the art from the time of his early experiments to the present. Numerous lantern slides and curves were shown.

With the wireless apparatus available up to 1895, Mr. Marconi said it was possible to detect the effects of electric waves over only very short distances, not more than a few hundred yards. In 1895 he discovered a new system which enormously increased the distance over which one could transmit and detect electric waves, and which proved at once sufficient to remove the limitations besetting the transmission of electric waves over long distances. The main feature of the new system was the use of elevated capacity aerials or vertical wires attached to one pole of the high-frequency oscillator and receiver—the other pole of which is grounded. Detailed descriptions of the apparatus used with this system were given.

In 1900 Mr. Marconi first put in practice the arrangement which is now in general use and which consists of the inductive association of the elevated radiating wire with a condenser circuit, which may be used to store a considerable amount of electrical energy and impart it at a slow rate to the radiating wire. The oscillations in a condenser circuit can be made to persist for what is electrically a long period of time; and it can be arranged that by means of suitable aerials these oscillations are radiated into space in the form of a series of waves which, through their cumulative effect, are eminently suitable for enabling good tuning and syntony between transmitter and receiver.

Fifteen years ago when wireless communication was established between England and France, over a distance of 30 miles, much discussion and speculation took place as to whether or not wireless would be practicable for much greater distances, and, Mr. Marconi said, a somewhat general opinion seemed to prevail that the curvature of the earth would be an insurmountable obstacle to long-distance transmission. In January of 1901 he carried out some successful experiments between two points on the south coast of England, 186 miles apart. The total height of these stations above sea level was only a fraction of what would have been necessary to clear the curvature of the earth but transmission was successfully accomplished. Subsequent tests demonstrated that by increasing the power and the area of the transmitting and receiving conductors transmission could be effected over great distances. Transmission of messages across the Atlantic was the next step.

In 1902 Mr. Marconi first noticed that daylight has a detrimental effect on the propagation of electric waves over great distances. The generally accepted hypothesis of the cause of this absorption of electric waves in sunlight, is founded on the belief that the absorption is due to the ionization of the gaseous molecules of the air affected by ultra-violet light, and, as the ultra-violet rays which emanate from the sun are largely absorbed in the upper atmosphere of the earth, it is probable that that portion of the earth's atmos-

phere which is facing the sun will contain more ions than that portion which is in darkness, and therefore this illuminated and ionized air will absorb some of the energy of the electric waves. Recent observations also reveal the interesting fact that the effects vary greatly with the direction in which transmission is taking place: the results obtained when transmitting in a northerly and southerly direction being often altogether different from those observed in an easterly and westerly one.

Research in regard to the changes in the strength of the received radiation which are employed for telegraphy across the Atlantic has recently been greatly facilitated by the use of sensitive galvanometers, by means of which the strength of received signals can be measured with a fair degree of accuracy.

Mr. Marconi stated that one of the objections made against wireless telegraphy is in regard to the possibility of interference between various stations and the confusion likely to arise when a number of stations are simultaneously operated in the vicinity of each other. He said although this confusion rarely arises in practice with proper up-to-date stations and apparatus, yet even with the old instruments when it did occur, it was not by any means such a serious matter as generally appeared to the public. He commended the attitude on the part of nations in regard to laws passed to prevent interference, but thought there is a danger of governments hampering the development of this new art by the imposition of too many rules and regulations. He stated, further, that in the case of wireless telegraphy, it is often an advantage that any station should be able to pick up a message which may not be actually addressed to it.

An important innovation in wireless, from a practical point of view, was the adoption at the Clifden and Glace Bay stations of air condensers composed of insulated metallic plates suspended in the air at ordinary pressure. In this manner, Mr. Marconi said, the loss of energy which would take place in consequence of dielectric hysteresis were a glass or solid dielectric employed, is greatly reduced. Another interesting feature of the Clifden plant is the regular employment of high-tension direct current for charging the condenser. Special generators are used.

In conclusion Mr. Marconi referred briefly to the recent disaster at sea, and the part that wireless played in the saving of lives.

Michael I. Pupin and Frank I. Sprague spoke briefly, following Mr. Marconi's address, paying a high tribute to the author for his work.

THE STORY OF THE "TITANIC" WIRELESS.

The Experiences of Harold Bride, Surviving Member of the Ill Fated "Titanic" Wireless Staff.

The *Carpathia*, the Cunard liner carrying the survivors from the wreck of the *Titanic* reached New York on the evening of April 18. The *Titanic*, after collision with an iceberg had foundered on the morning of Monday, April 15, with a loss of 1,595 persons. Just 745 were rescued, including 210 of the officers and crew of the stricken ship. To the credit of the wireless and the heroes manipulating the apparatus much must be written down. The "C. Q. D." and "S. O. S." flashed from the *Titanic* was caught up by the operator of the *Carpathia*, outward bound for Naples. Captain Rostron immediately put about and after steaming all night under forced pressure arrived in time to pick up the boats, but not until the pride of the White Star Line had foundered.

When the *Carpathia* reached New York, William Marconi, to whose genius much of the great development in wireless is due, was the guest in New York of John Bottomley, manager of the American Marconi Company. In company with a representative of the New York *Times*, Mr. Marconi visited the *Carpathia* upon its arrival at New York, and to them Harold Bride, the surviving member of the wireless staff of the *Titanic*, related his thrilling experience, which appeared in the *Times*.

"In the first place," said Bride, "the public should not blame anybody because more wireless messages about the disaster to the *Titanic* did not reach shore from the *Carpathia*. I positively refused to send press dispatches because the bulk of personal messages with touching words of grief was so large. The wireless operators aboard the *Chester* got all they asked for.

"When I was dragged aboard the *Carpathia* I went to the hospital at first. I stayed there for ten hours. Then somebody brought word that the *Carpathia's* wireless operator was 'getting queer' from the work.

"They asked me if I could go up and help. I could not walk. Both my feet were broken or something, I don't know what. I went up on crutches with somebody helping me.

"I took the key and I never left the wireless cabin after that. Our meals were brought to us. We kept the wireless working all the time.

"To begin at the beginning, I joined the *Titanic* at Belfast. I was born at Nunhead, England, 22 years ago, and joined the Marconi forces last July. I first worked on the *Hoverford*, and then on the *Lusitania*. I joined the *Titanic* at Belfast.

"I didn't have much to do aboard the *Titanic* except to relieve Phillips from midnight until some time in the morning, when he should be through sleeping. On the night of the accident, I was not sending, but was asleep. I was due to be up and relieve Phillips earlier than usual. And that reminds me—if it hadn't been for a lucky thing, we never could have sent any call for help.

"The lucky thing was that the wireless broke down early enough for us to fix it before the accident. We noticed something wrong on Sunday and Phillips and I worked seven hours to find it. We found a 'secretary' burned out, at last, and repaired it just a few hours before the iceberg was struck."

Bride told of waking to relieve Phillips, chief operator, who had been standing watch, when Captain Smith told them to get ready to send the call for assistance; how at first they joked over the matter while flashing out the international call; how the confusion increased; how the ship commenced to settle, and the call became more insistent. He told of the *Carpathia* taking them up and of its putting about and heading for their location.

"Our Captain had left us at this time and Phillips told me to run and tell him what the *Carpathia* had answered. I did so, and I went through an awful mass of people to his cabin. The decks were full of scrambling men and women. I saw no fighting, but I heard tell of it.

"I came back and heard Phillips giving the *Carpathia* fuller directions. Phillips told me to put on my clothes. Until that moment I forgot that I was not dressed.

"I went to my cabin and dressed. I brought an overcoat to Phillips. It was very cold. I slipped the overcoat upon him while he worked.

"Every few minutes Phillips would send me to the Captain with little messages. They were merely telling how the *Carpathia* was coming our way and gave her speed.

"I noticed as I came back from one trip that they were putting off women and children in lifeboats. I noticed that the list forward was increasing.

"Phillips told me the wireless was growing weaker. The Captain came and told us our engine rooms were taking water and that the dynamos might not last much longer. We sent that word to the *Carpathia*.

"I went out on deck and looked around. The water was pretty close up to the boat deck. There was a great scramble aft, and how poor Phillips worked through it I don't know.

"He was a brave man. I learned

to love him that night and I suddenly felt for him a great reverence to see him standing there sticking to his work while everybody else was raging about. I will never live to forget the work of Phillips for the last awful fifteen minutes.

"Then came the Captain's voice: 'Men, you have done your full duty. You can do no more. Abandon your cabin. Now it's every man for himself. You look out for yourselves. I release you. That's the way of it at this kind of a time. Every man for himself.'

"I looked out. The boat deck was awash. Phillips clung on sending and sending. He clung on for about ten minutes or maybe fifteen minutes after the Captain had released him. The water was then coming into our cabin."

A wave carried away the collapsible boat he had helped to unlimber, and as it swept past him Bride grabbed an oarlock and was dragged along. He was in this boat when it overturned, and then he and his companions were picked up by another—a loaded boat. His feet were jammed under a stanchion, smashed and frozen. Finally, the *Carpathia* came up and they were dragged aboard. One man was dead. It was Phillips. Worn out by his vigil, he had been washed off the ship, picked up, and died from exposure as help arrived.

"I felt somebody at my feet and felt the warmth of a jolt of liquor. Somebody got me under the arms. Then I was hustled down below to the hospital.

"After that I never was out of the wireless room, so I don't know what happened among the passengers. I just worked the wireless. The splutter never died down. I knew it soothed the hurt and felt like a tie to the world of friends and home.

"How could I then take news queries? Sometimes I let a newspaper ask a question and get a long string of stuff asking for full particulars about everything. Whenever I started to take such a message I thought of the poor people waiting for their messages to go—hoping for answers to them.

"The way the band kept playing was a noble thing. I heard it first while still we were working wireless, when there was a ragtime tune for us, and the last I saw of the band, when I was floating out in the sea with my life belt on, it was still on deck playing 'Autumn.' How they ever did it I cannot imagine.

"That and the way Phillips kept sending after the Captain told him his life was his own, and to look out for himself, are two things that stand out in my mind over all the rest."

Annual Report of the General Electric Company.

The twentieth annual report of the General Electric Company to the stockholders, signed by C. A. Coffin, president, for the year ended December 31, 1911, shows sales billed for the current year amounting to $70,383,854.34, as compared with $71,478,557.66 for 1910. The condensed statement follows:

	1911.	1910.
Sales billed	$70,383,854.34	$71,478,557.66
Cost of sales	62,460,557.36	63,134,601.63
Profit from sales	$ 7,923,296.98	$ 8,343,956.03
Add interest and discount, royalties and sundry profits	1,358,859.68	1,370,928.57
	$ 9,282,156.66	$ 9,714,884.60
Deduct interest on debenture bonds	371,015.07	717,395.02
	$ 8,911,141.59	$ 8,997,489.58
Add income from securities owned, profit on sale of securities & net appreciation of stocks .and bonds	1,651,664.02	1,858,202.55
Net profit for the year	$10,562,805.61	$10,855,692.13
Dividends paid	5,806,344.00	5,214,368.00
Surplus for the year	$ 4,756,461.61	$ 5,641,324.13

These figures do not include the business of the Fort Wayne Electric Works and the Sprague Electric Company. On June 1, 1911, the General Electric Company took title to the properties of the Fort Wayne and Sprague Electric companies. These companies have been dissolved and their assets and liabilities included in the balance sheet. These changes have resulted in the addition of $1,517,335.81 to the assets of the company, $276,610.72 to its liabilities, and $1,240,725.09 to its surplus.

In 1911, there were 388,520 orders, with a value of $69,851,275 compared with 338,272 orders with a value of $71,182,391 for 1910.

During the year $769,842.44 was expended for the purchase of sundry patents for applications and licenses under patents, patent litigation and miscellaneous expenses all of which has been charged to profit and loss as heretofore, leaving the patent account at $1.00.

On December 31, 1911, the book value of factory plants was $19,538,921.80, as follows: Schenectady, $9,125,720.24; Lynn, $4,283,763.29; Pittsfield, $2,148,699.46. Lamp Works, $1,314,871.82; Erie, $1,355,834.28; Fort Wayne, $938,102.37; Sprague, $371,930.34.

The action brought by the United States against the company and others, in connection with the manufacture and sale of incandescent lamps, has been terminated by the entry of a decree, in compliance with which the National Electric Lamp Company and its subsidiary companies, operating under patent licenses granted by the General Electric Company, have been dissolved. The plants and properties of these companies have been taken over and will be operated by the General Electric Company as part of its organization. It is believed that the business of the company in all of its various branches is now being conducted in such a manner as to avoid any possible ground for criticism as contravening the anti-trust law.

*CONDENSED BALANCE SHEET.

December 31, 1911.

ASSETS.

Patents, franchises and goodwill		$ 1.00
Cash		17,898,709.40
Stocks and bonds	$28,707,843.22	
Real estate (other than factory plants)	448,094.43	
Notes and accounts receivable	19,084,105.81	
Due from affiliated companies	2,891,760.79	
Installation work in progress	399,707.95	
	$51,531,512.20	
Merchandise Inventories:		
At factories	$22,709,581.39	
At district offices, in transit, etc.	3,352,929.95	
Consignments	367,472.68	
	$26,429,984.02	77,961,496.22
Factory plants (including all lands, buildings and machinery)	$19,538,921.80	
Furniture and fixtures other than in factories)	3.00	19,538,924.80
		$115,399,131.42

*Including the accounts of the Fort Wayne Electric Works and Sprague Electric Works.

CONDENSED PROFIT AND LOSS ACCOUNT.

December 31, 1911.

INCOME.

Sales billed		$70,383,854.34
Less cost of sales		62,460,557.36
		$ 7,923,296.98
Interest and discount, royalties and sundry profits		1,358,859.68
Income from securities owned		1,285,278.65
Profit on securities sold		240,000.66
Net appreciation in value of stocks and bonds, etc.		126,375.71
		$10,933,820.68

DEDUCTIONS.

Interest on debentures	$ 371,015.07	
Dividends on stock	5,806,344.00	6,177,359.07
Net gain in surplus for the year		$ 4,756,461.61
Add surplus taken over from the Fort Wayne and Sprague companies		1,240,725.09
Total addition to surplus		$ 5,997,186.70
Surplus at January 1, 1911		23,022,705.82
Surplus at December 31, 1911		$29,019,892.52

*CONDENSED BALANCE SHEET.

December 31, 1911.

LIABILITIES.

Gold coupon debentures:		
5 % series of 1892.	$ 38,000.00	
3½% series of 1903.	2,047,000.00	
5 % series of 1907.	721,000.00	
		$ 2,806,000.00
Accounts payable	$4,305,172.93	
Accrued taxes	207,043.94	
Advance payments on contracts	147,153.45	
Accrued interest on debentures	33,014.58	
Dividend payable, January 15, 1912	1,545,654.00	
		6,238,038.90
Capital stock issued		77,335,200.00
Surplus:		
At Jan. 1, 1911	$23,022,705.82	
Added during yr.	5,997,186.70	
Total, Dec. 31, 1911		29,019,892.52
		$115,399,131.42

AMERICAN ELECTROCHEMICAL SOCIETY.

Twenty-first General Meeting, Boston, April 18, 19 and 20.

The American Electrochemical Society started upon the second decade of its existence with a meeting held at Boston, Mass., April 18, 19 and 20. The opening session, as well as those on Friday, was held in the Chemical Laboratory of the Massachusetts Institute of Technology. It was called to order by President W. R. Whitney. Reports were presented by the Board of Directors, the secretary and the treasurer. These showed that the number members added to the roll during the year was 110. The present membership is 1,362. The treasurer showed a surplus of $1,300 for the year. The invested assets of the Society now amount to over $5,500. The Board of Directors has voted a sum not to exceed $250 to be applied to the furtherance of experimental research work during the coming year. A committee of three will be appointed to supervise this work.

An amendment to the constitution was then adopted, the purpose of which was to make the voting for nominations secret and to give any nominee the privilege of withdrawing his name.

The results of the letter-ballot for the election of officers were as follows: President, W. Lash Miller; vice-presidents, F. A. Lidbury, E. R. Taylor, William Brady; managers, E. F. Roeber, L. E. Saunders and L. Kahlenberg.

The first paper to be presented was one by Carl Hering entitled "Uniformity and Simplicity in Electrochemical and Electrothermal Calculations."

The author urged that the society make recommendations in order to attain uniformity in the use of units, terms, etc. He favored the use as practical units of some decimal multiples of the corresponding absolute units. He advocated particularly the use of watts or kilowatts to represent power, even when in mechanical or thermal form, and the abandonment of the caloric or the British thermal unit in connection with electric appliances; energy, including heat, to be measured in watt-hours or kilowatt-hours. This would include the statement of specific heats, latent heats, etc. He recommended the adoption of a unit of thermal resistance. For this he favored the thermal ohm, a resistance which will permit the transference of one watt per unit volume when the difference of temperature is one degree centigrade.

After a brief discussion by M. L. Griffin and J. W. Richards, Dr. Hering presented a second paper entitled "Effects of the Variations of Thermal Resistivities With the Temperature."

F. A. J. FitzGerald, J. W. Richards, W. L. Miller, C. B. Thwing, L. H. Duschak, William C. Arsen, F. W. Robinson, S. S. Sadtler and William C. Bray joined in the discussion of this paper.

F. A. J. FitzGerald then presented a paper entitled "Experiments on Heat Insulation." This gave comparative results of the heat transmitted through a number of kinds of furnace bricks in an experimental furnace. Ordinary building brick gave best results. Surface conditions probably contributed largely to the results.

This paper was discussed by Messrs. Hering, Imberg, Kohn, Duschak. The author stated that fire bricks painted with aluminum paint give much better insulation than when painted with lamp black or white lead. The effect of air cells in insulating material varies greatly with the temperature. They are more effective at low temperatures and radiation does not count for much.

The next paper was by C. T. Randolph and was entitled "The Thermal Resistivity of Insulating Materials." This paper described the measurements on a number of compressible substances which are put in in small particles and hence contain a large number of air-cells. They were electrically heated upon one side and on the other cooled by a copper plate in connection with flowing cold water, the rise in temp rature of which could be measured. The variation in conductivity with temperatures up to 600 degrees was noted. Results are given for asbestos, mineral wool, steel wool, woolen fibers, "poplox," cotton, eiderdown, granular quartz, lamp black, etc. In most cases the conductivity decreased with increasing pressure.

This paper was discussed by Carl Hering, W. L. Miller, H. J. Skinner and J. W. Richards.

L. E. Saunders presented a paper on "Temperatures of the Silicon-Carbide Furnace."

This paper was discussed by Messrs. Bancroft, Imberg, Burgess, Thwing, Tucker, Whitney, Richards and Kohn.

R. Turnbull then presented a paper entitled "Furnace Electrodes Practically Considered."

Carbon electrodes consist simply of some kind of carbon mixed with pitch or tar and then melted and baked. While this process is simple it is very hard to determine the conditions which lead to good and bad electrodes. It was soon found that retort carbon gave better results than other forms then in use. Today, nearly all manufacturers can turn out a fairly satisfactory electrode. This is largely due to the use of anthracite coal, the best electrodes in use today being made from that material. The molded screw on the electrode has done away with the stub and the trouble of changing electrodes. Satisfactory electrodes are now made up to 24 inches in diameter and seven feet long. Current should enter the electrode as near as possible to the furnace. A current-density of 30 to 35 amperes per square inch was recommended.

It was pointed out by Carl Hering that the skin effect becomes very noticeable in large electrodes.

The next paper was by J. W. Richards and was entitled "Gas Circulation in Electrical Reduction Furnaces." It discussed the scheme used at Domnarfvet, Sweden, for cooling the furnace arch and offered arguments against that method and in favor of water cooling. Written discussion on this paper was presented by Thomas D. Robertson and J. A. Leffner.

J. R. Wilson then presented a paper entitled "High-Tension Equipment for Electrochemical Plants."

The average manufacturing plant differs from a power station in that the men are usually inexperienced, consequently the installation should be made as nearly foolproof as possible. No unauthorized person should be allowed in the high-tension department. All operating devices on the low-tension side should be placed so that employees can get at them without leaving their places. All exposed dead metal, such as frames, cases, etc., should be well grounded and in such a way that it may be easily inspected. One side of the secondary circuit should also be grounded. The author then discussed many features of the installations in the vicinity of Niagara Falls, where the primary tension is 12,000 volts. He prefers a special intake tower for bringing in the primary line except where the distribution is underground. This tower should contain all the incoming switches, lightning arresters, main circuit-breakers and necessary meters, and it should be centrally located. Each incoming line should have a disconnecting switch to be used only when the main circuit-breaker is open. This main circuit-breaker should be of ample capacity, especially where outside power is used, as it may have to open the entire power-house load. No high-tension conductor should be within 7.5 feet of the floor. Water rheostats are sometimes placed between the disconnecting switches and the transformers, a single-pole, oil circuit-breaker, being used to short-circuit. This is very desirable where transformers have to be started under full load. In furnace work it is especially desirable to have the transformers as near to the work as possible. The transformer room should, therefore, be arranged parallel to the furnace room and separated from it by a brick or concrete wall. The transformer room should be roofed over to exclude dust. The low-tension conductors should be interlaced, and where reinforced-concrete dividing walls are used attention should be given to the placing of the reinforcing steel so there can be no closed magnetic circuits.

A written discussion was presented by J. L. Harper.

W. Sykes presented a paper on "Power Supply to Electric Furnaces for Refining Iron and Steel."

It has been generally assumed that cheap power is necessary for electric furnaces, but this is not necessarily the case as excessive electrode consumption or excessive wear of linings may easily offset a considerable difference in cost of power. In many furnaces, especially arc furnaces, the cost of power is by no means a controlling feature. Individual characteristics of different types of furnaces influence to some extent the power cost. Fifteen-ton arc furnaces use electrodes 24 inches in diameter, carrying 12,000 amperes. This represents probably the limit, and if larger furnaces are built it will no doubt be with a multiplicity of electrodes. The effect on power-factor is very noticeable as the capacity increases. With the 15-ton furnace just mentioned the power-factor is approximately 80 per cent, since the reactance voltage is 60 per cent of the impressed voltage. The maximum power in a system containing reactance occurs when the resistance voltage is 71 per cent of the impressed voltage. The reactance in an arc furnace is usually sufficiently high so that no particular damage is done by short-circuits. On 25 cycles a short-circuit current is about twice the normal current. Induction furnaces have the advantage that electrodes are eliminated, but have the disadvantage of a low power-factor. Better conditions are obtained with the Röchling-Rodenhauser furnace than with the Kjellin type. A low power-factor appreciably reduces the capacity of a generating plant. It is, consequently, sometimes advisable to use a motor-generator set. If building a generating plant, especially for the purpose, large kilovolt-ampere capacity should be provided. The cost of generating power from water power and from steam plants was considered and the consumption of power per unit of steel or of pig iron given for various cases.

This was followed by a paper by T. F. Bailey entitled "Further Development of Electric Furnaces for Heating Bars and Billets," which gave a detailed description of some special furnaces for this purpose. J. W. Richards stated that with a better planning of a furnace and better insulation the heat efficiency could be nearly doubled, especially if a process is used which supplies the heat more rapidly.

Electric Conduction.

At the session on Friday morning President Whitney presented his annual address, which was a general consideration of the subject of electric conduction.

After the conclusion of the address there was a general symposium on the subject, the first address being by D. F. Comstock.

Dr. E. Weintraub presented a paper on "The Conductivity of Salts."

The following then participated in the general discussion of the subject. W. C. Bray, C. J. Davisson, M. W. Franklin, H. M. Goodwin, C. A. Kraus, S. J. Lloyd, H. N. McCoy, R. A. Millikan, P. G. Nutting and O. W. Richardson. Written discussions were contributed by S. C. Lind, D. McIntosh and E. W. Washburn.

Dry Cells.

The session on Saturday morning was held in Pierce Hall, Harvard University, Cambridge, Mass. The report of the Committee on Standard Methods for Testing Dry Cells was presented at this session by the chairman of the Committee, C. F. Burgess. It will be given at some length in a later issue.

The report was discussed by F. H. Loveridge, J. F. Stevens, John W. Brown and J. W. Richards. As the report was only tentative, the Committee was continued.

A paper dealing with the "Performance of Dry Cells," by Carl Hambuechen, was presented by Professor Burgess.

The author stated that the three important characteristics of dry cells by which merit is judged are the short-circuit current, the shelf life and the watt-hour output. The latter is of most importance, and the first is of least importance, but is, perhaps, the most commonly used. Consequently some manufacturers have, during the past few years, developed cells which give an increased flash test, and curves were given showing this general increase, which amounts to over 50 per cent. This has not been accompanied by any improvement in durability, shelf-wear or capacity. The adoption of better methods of testing will probably result in more attention being given to long life and energy output. The latter are especially desirable for telephone and alarm service and the use of cells for emergency purposes. Curves were given showing the average shelf life as determined by the customary flash test. Cells having the highest initial flash deteriorate most rapidly. However, a falling off in the flash test does not necessarily indicate a corresponding reduction in useful capacity.

A paper by F. C. Mathers and O. R. Overman on "Effect of Addition Substances in Lead-Plating Baths" was presented by C. G. Schluederberg. This described very extended experiments designed to determine the best addition-substance for use in lead-plating. The advantage of such substances has been known for some time and good results have been obtained by their use with a solution of lead perchlorate containing some free perchloric acid. The substances studied include inorganic material, essential oils, resins and gums, sugars and starches, alkaloids and their derivatives, glucosides, proteids, ferments, phenols and various other substances. Oil of cloves proved to be the best material for commercial use. About one-third of a pound is required per ton of lead. This paper was discussed by Victor Engelhardt, W. D. Bancroft.

C. W. Bennett presented two papers entitled "A Rotating Cathode" and "Tensile Strength of Electrolytic Copper on a Rotating Cathode."

C. W. Bennett and D. S. Cole presented a paper entitled "The Regeneration of Sulphated Storage Cells."

The method of regeneration recommended was to produce sodium hydroxide in the sulphated grid. This is done by electrolysis with sodium sulphate as electrolyte, the current being sent through the cell in the direction of charging. Sodium hydroxide is then formed in the pores of the lead plate and sulphuric acid at the lead-dioxide plate. The results obtained were remarkably good. The concentration of sodium sulphate recommended is 200 grams of the crystallized salt per liter. It should be chemically pure. After treatment the plates need not be thoroughly washed, but dipping in water is sufficient. The time of charging for the worst cells was about 60 hours at the eight-hour rate. The method was tried upon a battery of 52 cells which had been improperly handled and were in bad condition. Before the treatment the energy efficiency was found to be 42.5 per cent and the capacity was only half of the rated capacity. After treatment the energy efficiency was found to be 81.1 per cent, the energy capacity was 88.7 per cent of rated capacity and the ampere-hour capacity 96.9 per cent of rated capacity. This battery had a capacity of 7.5 amperes and the cost was about 20 cents per cell. The gain in efficiency would pay for the treatment after 90 charges and discharges, providing energy cost five cents per kilowatt-hour.

The following papers were also presented at the meeting: "Vacuum-Furnace Metallurgy," by C. G. Fink; "The Boltwood Standard of Radioactivity," by Merle Randall; "The Influence of Diffusion on the Electromotive Force Produced in Solutions by Centrifugal Action," by W. Lash Miller; "Potential Differences at the Junction of Immiscible Phases," by R. Beutner; "Electrical Endosmose," by W. D. Bancroft; "Smee's Theory of Electrolytic Deposits," by W. D. Bancroft; "The Volatility of Zinc Oxide," by L. O. Kowalke; "An Electrolytic Method for the Reduction of Blue Powder," by Warren F. Bleecker; "On the Nature of Zinc Cementizing (Sherardizing)," by Arden R. Johnson and Willis R. Woolrich; "The Effect of Various Substances on the Rate of Corrosion of Iron by Sulphuric Acid," by O. P. Watts. An address was made by T. W. Richards, professor of chemistry at Harvard University. Before adjourning a motion was passed in appreciation of the courtesies extended to the Society by the Massachusetts Institute of Technology, Harvard University, General Electric Company, The American Steel & Wire Company, The Norton Company, the Local Committee and the Ladies' Committee.

A dinner was held on Friday evening at the Algonquin Club. Thursday afternoon was devoted to an excursion to Worcester to visit the steel works and an alternate excursion to the works of the General Electric Company at Lynn. On Thursday evening an illustrated lecture was given by Charles W. Cross, professor of physics in Massachusetts Institute of Technology.

New Electrical and Mechanical Appliances

A New Fuse for Potential Transformers.

The General Electric Company has placed on the market a potential fuse which will open the circuit successfully under excessive current conditions, when connected to systems of large capacity, with the action accompanying the blowing so slight as to be scarcely noticeable. There is no flame or other external disturbance. Because of this fact there is no danger to adjacent apparatus, and the fuse may consequently be located in any convenient position, near the switchboard or elswhere, no cells being necessary.

In appearance this fuse resembles the ordinary type of inclosed fuse, the fuse proper being a small wire which passes

15,000-Volt and 6,600-Volt Potential-Transformer Fuses.

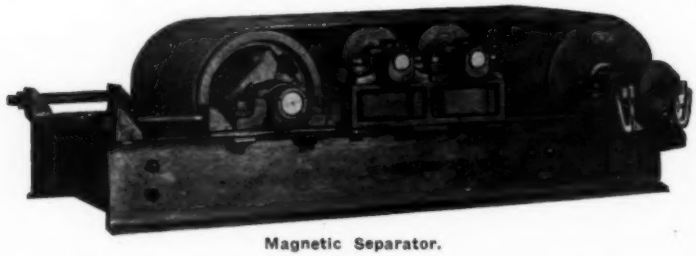
through the center of the fiber tube which is 1.5 inches in diameter. The wire is soldered at each end to the center of a metal cap, which is placed over the end of the tube. Surrounding the fuse wire is a filler which absorbs such a large percentage of the arc, that the blowing of the fuse causes no external disturbance. The metal caps are provided with vent holes, so arranged that the filler will not leak out. The performance under short-circuit or with abnormal current on the line is independent of the kilowatt capacity of the bus.

This fuse is intended primarily for use on instrument transformers. It can be furnished with special mountings to make it applicable to any use conforming with its voltage and ampere rating.

A Magnetic Separator for Heavy Work.

The magnetic separator shown in the accompanying illustration was built of a somewhat special design for the Southwestern Portland Cement Company, El Paso, Texas, by the Cutler-Hammer Clutch Company, of Milwaukee, Wis. To bear the heavy weight of the material conveyed by the belt, two idler pulleys were mounted between the tail pulley and the magnetic pulley, which is at the right end. An I-beam frame is used for mounting. This equipment is employed for separating stray iron and other magnetic materials from the coal which is used in the kilns, as the presence of even small quantities of iron or steel is considered undesirable. As the belt turns, the coal is thrown to the front of the magnetic pulley and conveyed away, while the magnetic material is attracted and snapped off below, being entirely separated from the coal.

The current used for energizing the inclosed brass-jacketed coils of the magnetic pulley is fed through the two carbon brushes shown resting on the slip rings on the extension of the pulley shaft.



Magnetic Separator.

Rapidly Reversing Motor.

The immense inertia which is overcome and the speed which has been developed in electrically driven machinery of recent years is almost inconceivable. One instance of these two feats which stands out is that of the reversing motor drive for large plate mills installed by the Crocker-Wheeler Company last year in the works of the Indiana Steel Company, at Gary, Ind. The weight of the revolving parts of the reversing motor is about 100,000 pounds, and it is ten feet in diameter. The reversing of this motor and of the rolls from fourteen revolutions per minute in one direction to fourteen revolutions per minute in the other is accomplished in the amazingly short time of 0.9 second. This means that this electrically driven mill reverses more quickly than any other of its class. Power for operating this reversing motor is supplied by a motor-generator set having a 60,000-pound steel flywheel, ten feet in diameter, running at 500 revolutions per minute.

Portable Soundproof Telephone Booths.

The use of soundproof telephone booths is being rapidly extended. Telephone engineers agree that a means for private conversation is essential to the best service of a public station. Persons within hearing distance of a public telephone will often deter a possible patron from using it, owing to the private nature of the intended communication. The income of the telephone companies would be materially increased if the service of the pay stations also included absolute privacy.

After considerable experimental work a practical soundproof booth for telephone service has been developed by the Western Electric Company. The booths have double, interchangeable walls, with an air space between which excludes outside noises and secures privacy. They are mounted on rubber cushions. Only selected lumber, thoroughly seasoned and kiln dried, is used in the manufacture of these booths.

The doors can be furnished in either the single or double pattern to swing to the right or left, as desired. Wooden panels are interchangeable with glass sashes, which are removable to facilitate cleaning. Compartment booths can be supplied in any number desired. The compartments are independent and sound insulated, though the outside appearance is as of one booth. Stools, curtains and rugs can also be furnished to suit any model or size.

Westinghouse Direct-Current Turbogenerators.

Westinghouse type T, direct-current, turbogenerator units are finding wide application where a simple, compact, reliable generating set is desired. Many are used for exciter sets in alternating-current generating stations, for lighting and power in industrial plants and in office and apartment buildings, for storage-battery charging in railway-signal work, and for train lighting. They are particularly applicable for exciter service in modern generating stations where the steam pressure exceeds 125 pounds per square inch because small reciprocating engines ordinarily used for driving exciters are usually designed for pressures not greater than 125 pounds per square inch; where the boiler pressure exceeds this value, a reducing valve must be used with such engines. Type T turbines operate directly on pressures up to 200 pounds and with steam superheated 150 degrees Fahrenheit.

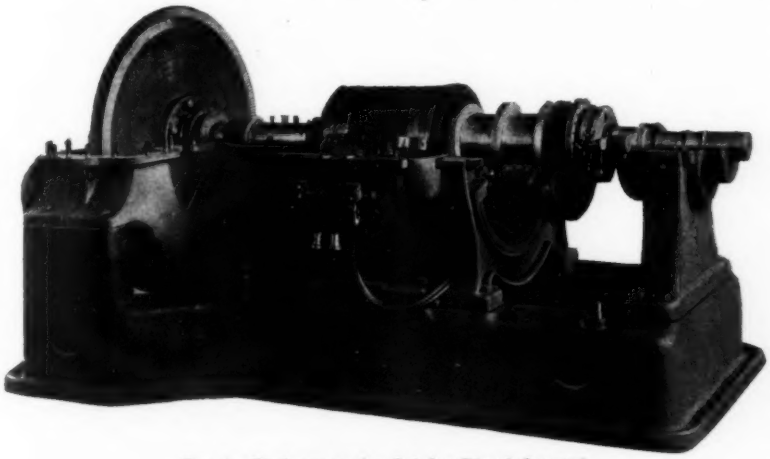


Fig. 1.—Turbogenerator Set for Direct Current.

As compared with reciprocating-engine sets the features in favor of the turbogenerator set are: 1.—There are few parts that require attention because of wear, there are very few bearings to oil, and no stuffing boxes to pack; there are no reciprocating parts to wear out and no steam cylinders to be oiled. 2.—A reciprocating-engine set occupies from one and a half to several times as much space (depending on the speed and other characteristics) as does a turbogenerator set. 3.—The first cost and the installation costs are less for a turbo set than for an equivalent reciprocating-engine set; expensive foundations are not required for a turbogenerator unit. 4.—There is no oil in the exhaust steam.

The line of type T sets includes machines of the capacities most in demand of from 10 to 200 kilowatts. Standard voltages are 125 and 250. Three-wire generators for 125 and 250 volts can be supplied. The steam-pressure range is from 75 to 200 pounds per square inch. Either shunt or compound-wound generators can be furnished. Compounding can be varied by adjusting the shunt.

The turbine (Fig. 1) is of the single-wheel impulse type. The wheel is mounted directly on the end of the armature shaft. Although only one impulse wheel is used, an unusually high efficiency is obtained by using the steam two or more times on the one wheel. The governor is of the fly-ball type. The weights are hung on hardened-steel knife edges, minimizing friction. In case of overspeeding, the automatic safety-stop throttle valve is tripped, shutting off the steam.

Type T generators are of the commutating-pole type which insures sparkless commutation with a fixed brush position at all loads within the capacities of the machines. The frames are of cast iron. Bolts hold the pole pieces to the frames. All frames are divided horizontally. The main poles are built up of soft sheet-steel punchings. The use of bolted-on poles permits of uniform pole spacing and in addition renders possible the removal of any individual pole. The commutating poles are of steel and are also secured to the frame with bolts. The main field coils are either shunt or compound wound. Shunt coils are wound on forms that provide a large radiating surface; series coils are wound of bare copper bar. The commutating-pole coils are also wound of bare copper bar held in position with insulated bolts. The ventilation is thorough.

The brush-holders are mounted on rigid arms and the brush tension can readily be adjusted to keep it uniform as the brush wears away. The armature coils are form wound, interchangeable, and thoroughly insulated. The spaces between the coils at the ends of the armature are packed with insulating material to prevent the entrance of dirt. The commutators consist of hard-drawn copper bars insulated with mica. Steel rings shrunk around the bars but insulated therefrom prevent distortion by centrifugal stresses.

A complete oiling system of the type best adapted to the service is provided with each turbine. In the smaller sizes the well known ring oiling scheme is employed. In the larger turbines the oil is circulated through a closed system, by means of a rotary pump driven by the main shaft through positive gearing.

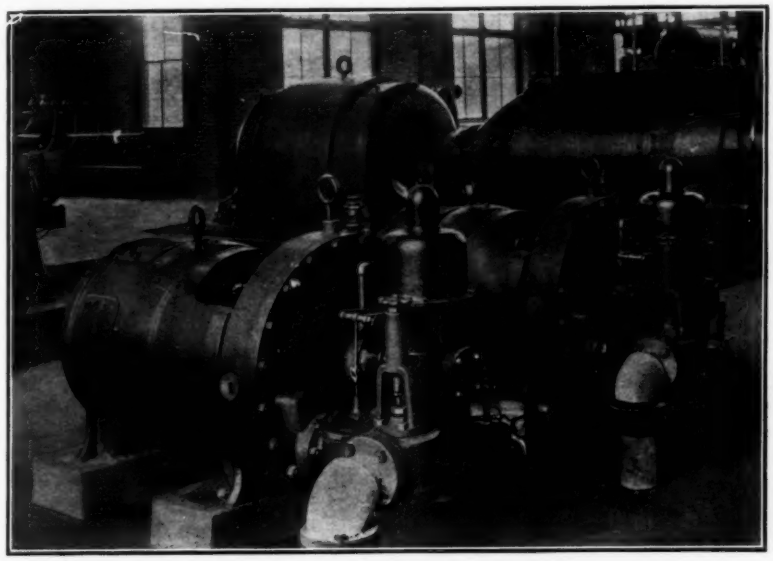


Fig. 2.—Two Turbine-Driven Exciter Sets.

All parts of the turbine are readily accessible for inspection or repair. The upper half of the cylinder or casing may be removed, as shown in Fig. 1, without interfering with the valve or governor mechanism, and, if necessary, the wheel or entire rotor may be removed from the casing.

Generally speaking, the steam consumption of turbines of small powers compares favorably with the performance of automatic high-speed engines of similar capacity. As Westinghouse turbines are carefully tested in the shop before shipment, there can be no uncertainty as to their performance. The guarantees of steam consumption are based on an average of actual test results plus a comfortable margin.

Among the many interesting installations of these generating sets is a group of two 25-kilowatt sets operating at 3,500 revolutions per minute and shown in Fig. 2. These provide excitation for large turbogenerators in the plant of the New York & Nassau Construction Company at Douglaston, Long Island, and have proved exceedingly satisfactory in this service because of their reliability.

Porcelain Socket for 220 Volts.

Pass & Seymour, Incorporated, Solvay, N. Y., has put on the market a 220-volt porcelain socket, known as catalog No. 61,217. While this article has been on the market before, the design has been radically changed, notably in the separation of the leading-in wires. The socket has a key, as is evident in the accompanying illustration.

220-Volt Porcelain Socket.

Annual Meeting of the Joseph Dixon Crucible Company.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company, held at the company's main office in Jersey City, N. J., on April 15, the retiring board of directors, consisting of George T. Smith, William Murray, Edward L. Young, William H. Corbin, George E. Long, William G. Bumsted and Harry Dailey, was unanimously re-elected. Officers elected for the ensuing year are as follows: George T. Smith, president; W. H. Corbin, vice-president; George E. Long, treasurer; Harry Dailey, secretary; J. H. Schermerhorn, assistant treasurer and assistant secretary.

Improved Vaporproof Fittings.

Since electricity was first introduced into places having a vapory or saturated atmosphere there has been a demand for a fitting which would withstand the actions of any kind of atmosphere that it might be subjected to.

This problem has in all probability been solved by the fittings now placed on the market by the Crouse-Hinds Company, of Syracuse, N. Y. These fittings are known as the V and V H series of condulets which are made in a number of different styles as desired by the purchaser. This vaporproof fitting consists of a hub of cast iron, a socket or receptacle, some rubber gaskets, a glass globe and heavy guard.

The essentials to be considered in a condulet of this kind are: first—a fitting that will resist all action from the outside; second—a fitting that will inclose and protect wiring and prevent interior corrosion. These essentials are taken care of b ·using a cast-iron fitting, as cast-iron is best in resisting the action of moisture and many corrosive vapors.

Changes in the interior arrangement of the condulet or fitting make it necessary to use a special two-piece porcelain receptacle where it was formerly customary to use a wall receptacle. The base of this two-piece receptacle has two ears that rest upon and are screwed to pillars which are part of the casting

All the wiring is done on the base of the receptacle. After these joints have been securely made, a rubber gasket is placed on the seat or flange which lies about an inch below the edge of the casting. Over this is placed a brass cover whose outer rim rests upon the gasket. This cover has an opening in the center to receive the cap of the receptacle; this cap is made with a collar to overlap the inner edge of the cover; between this cap and the brass cover is a rubber gasket.

Two tightly fitting screws bevelled at their tips to fit seats in the lower part of the receptacle serve to fasten this upper half of the receptacle and also hold the brass collar and gaskets. These two screws also form the electrical connection necessary between the lower and upper parts of the receptacle.

Immediately over the cover and above the globe seat another gasket is placed which is made of a rubber and duck mixture so it will retain its shape when it is necessary for any reason to take it out. Against this gasket the heavy glass globe is firmly turned into place by means of threads on the globe's outer surface and grooves corresponding in the casting, thus making

Several Forms of the New Vaporproof Fittings.

Installation of Vaporproof Fittings in Large Bath House.

the whole fitting both vapor and waterproof. But should the glass globe be broken while in service, there is still no chance of water or vapor getting near the wiring, as it is fully protected against the occurrence of just such emergencies.

The chances of the glass globe meeting with mishap, however, are exceedingly small as it is made of one-eighth-inch glass, which is protected by a heavy substantial guard.

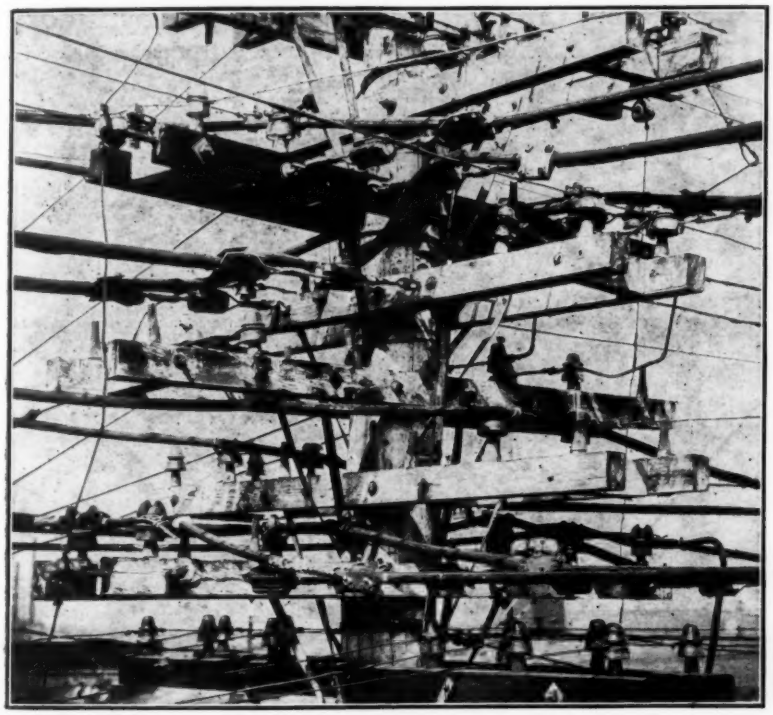
This guard is somewhat different from the style formerly in use, for instead of screwing on the outer surface of the casting, it is provided with a combined cam and lever that engages a groove in the casting. Holes are provided in the base ring and lever to receive a small padlock, the use of which protects guard, globe and lamp from removal by any unauthorized persons.

These fittings are now used in the famous Sutro Baths in California and have proven very satisfactory. The rooms in these baths, let it be understood, are full of a salty vapor over 90 per cent of the time and salt will corrode and destroy almost any metal, in time. These fittings have stood the test in this atmosphere for a longer time than any other so far tried and were still in good condition on last inspection.

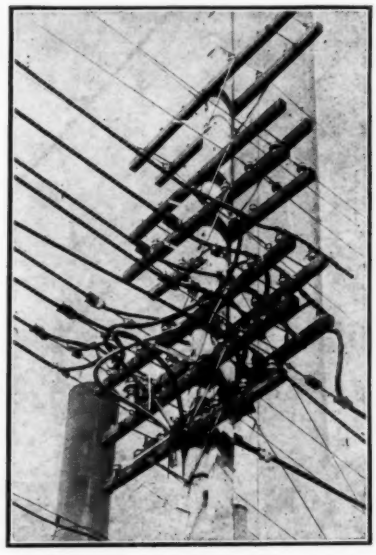
All of these condulets are made in either heavily enameled or galvanized cast iron.

Cable Clamps Facilitate Difficult Line Jobs.

In the two accompanying illustrations are shown some difficult pieces of overhead cable work recently executed in Mobile, Ala., on the lines of the Mobile Electric Company. The larger view shows a very crowded corner pole bearing 500,000 and 1,000,000-circular-mil cables. These cables could not be held in place without very powerful cable clamps. In the smaller view is shown a cable pole near the power house. These cable clamps not only greatly facilitated the stringing of the cables, but successfully held them without any trouble. The clamps used were manufactured by W. N. Matthews & Brother, St. Louis, Mo.



Use of Cable Clamps for Holding a Multiplicity of Large Cables on a Corner Pole.



Cable Clamps on Pole Near Power House.

A New Alloy.

A new white, non-corrosive, and malleable alloy of iron, nickel and copper has been patented by G. H. Clamer, of the Ajax Metal Company, Philadelphia, Pa. This alloy may be rolled into sheet, rods or bars, or drawn into wire, and may also be cast in sand. It has a whitish color, and can be made in the following range of percentages: iron, 30 to 70 per cent; nickel, 25 to 50 per cent; copper, 5 to 20 per cent.

Pure copper and iron will alloy in all proportions and form a homogeneous mixture; but when carbon is present, as it is in steel or cast iron, the two metals do not alloy well and hard nodules separate, depending upon the quantity of carbon. When cast iron is used for alloying with copper there is almost a perfect separation. In the alloys patented, it is stated that carbon should not be present to any extent or there will be a separation of hard nodules in the metal. If, however, carbon is present, then the tensile strength of the alloy is increased but the quantity should not exceed 0.2 per cent in order to have the best conditions. The strength of the alloy is high, and the inventor states that a mixture of iron 65 per cent, nickel 25 per cent, copper 10 per cent, and carbon 0.2 per cent has the following physical properties: tensile strength 96,100 pounds per square inch, elastic limit 51,750 pounds per square inch, elongation in two inches, 42 per cent, reduction in area 53.7 per cent.

To make the alloy, the metals are melted so that carbon is kept low and a small amount of manganese or magnesium added for deoxidising purposes.

The Holophane Company Removed to Cleveland.

The sales department of the Holophane Company will remove on April 27 from Newark, Ohio, to Cleveland, Ohio, where it will occupy an entire floor of the Vickers Building, located at Sixty-sixth Street and Euclid Avenue.

As previously announced, the Holophane Company and the Fostoria Glass Specialty Company, of Fostoria, Ohio, are being merged into one, and it is probable that a new name will be given to the combined organization, which is controlled by the General Electric Company. Definite announce-

ment upon this point has not yet been made.

The new organization will manufacture and sell the various different lines heretofore listed by both companies, including Holophane prismatic, Veluria and Iris glass reflectors, Holophane-D'Olier steel reflectors and numerous specialties. These comprise what is probably the most complete assortment of illuminating glassware offered by any one manufacturer and give this consolidated company a commanding position in the industry.

Although all details of the new organization have not yet been worked out, it is known that the sales and engineering departments will be directly in charge of V. R. Lansingh and the manufacturing department will be under E. O. Cross, who will take charge of both the Newark and Fostoria plants.

Armature and Coil-Testing Sets.

The advantage of using alternating current for testing purposes is well exemplified by the facility with which armatures and individual coils may be tested for open and short-circuits, using a testing set such as illustrated herewith. The Westinghouse Electric & Manufacturing Company has found these devices so satisfactory in its own works that it has decided to offer them to the trade, with the belief that they will prove particularly acceptable. The sets here described are divided into two classes, one for testing the individual coil and one for the completed armature.

A device for locating faults in armature and field coils before the winding is put in place, is illustrated in Fig. 1. Its use saves further labor on a defective coil. The apparatus consists of an E-shaped electromagnet with a detachable yoke. An exciting coil is on the middle leg of the E. On the back of the E, between the middle leg and either outside leg are wound two small coils so connected that the electromotive forces induced in them oppose each other, and accurately balance so that under normal conditions no current flows.

The field or armature coil to be tested is placed over one of the outer legs of the E and the yoke is omitted. If the tested coil is without fault it has n effect on the flux distribution. If, however, a leak or short-circuit exists, a current is induced in the tested coil which so alters the distribution of the flux that more passes through one of the detecting coils than through the other, inducing higher voltage in one than in the other and thus causing a current to flow through them. Such current can be detected by means of a zero-center instrument, or by means of a special telephone receiver.

To locate a short-circuit in a coil by burning it out, the coil is placed on the middle leg of the E, the detachable yoke put in place, as shown in Fig. 1, and the exciting coil connected to the line for a short time.

The device for testing complete armatures, illustrated in Fig. 2, consists of a laminated iron core in which an alternating-current magnetic flux is set up by connecting the terminals of its exciting coil to a source of alternating current. When either a direct-current or an alternating-current armature of the commutator type is placed against the face of this core, which is shaped to fit an armature, an alternating flux passes through the armature core. If the armature winding is correct, the electromotive forces generated counterbalance each other and no current passes through the winding.

Passing a piece of metal or a knife blade around the commutator, short-circuits in succession each of the coils that have one side under the testing pole. If there is no fault in the winding a decided spark occurs as the knife blade leaves each bar. Absence of spark between two bars indicates either a short-circuit, an open-circuit, or a reversed coil in the windings. A short-circuit or reversal will cause a local current in the coil, which will generate a flux around the slots in which the coil lies. Such a local flux can be detected by running over the surface of the armature a piece of sheet iron held lightly, bridging from one tooth to the next successively. A local flux caused by a short-circuit or reversed connection will attract the piece of iron when it bridges across the slot containing the defective coil. If no such local flux is detected, the fault disclosed by the sparking test is due to an open-circuit condition.

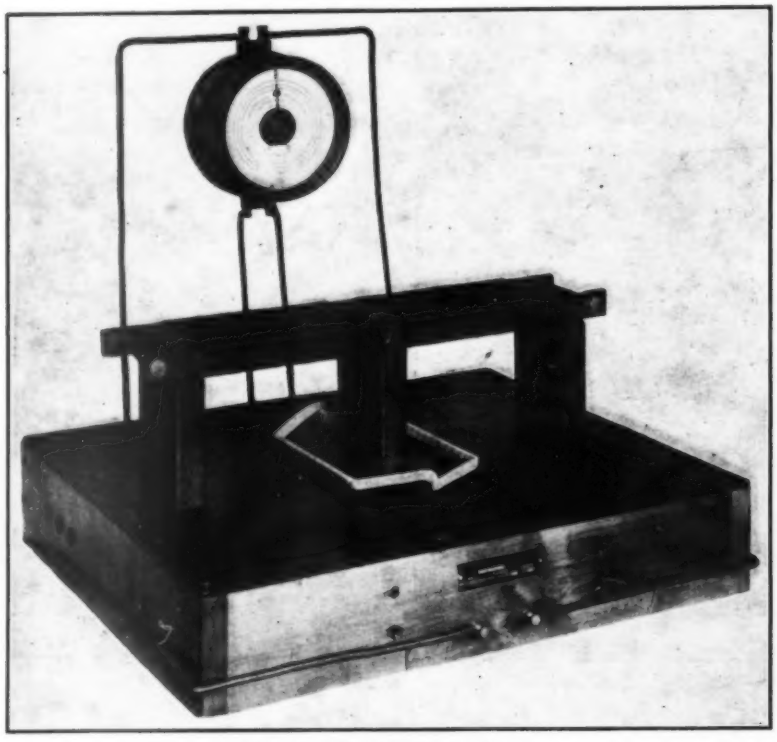


Fig. 1.—Coil-Testing Apparatus.

Fig. 2.—Armature-Testing Set.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

EVERETT, WASH. — A 25-year lighting franchise has been granted to F. I. Anderson.

OAKFIELD, WIS.—A battery system will be installed in the Oakfield electric light plant. C.

HAMBURG, ARK.—This city will issue additional bonds for the extension of the electric light plant.

PURCELL, OKLA.—This city has voted bonds for $100,000 to erect an electric light and water plant.

JAMESTOWN, N. D.—Bids will be taken May 27 for installing a "White Way" on the business streets. C.

DEWITT, NEB.—The Dewitt Light & Power Company has been incorporated with a capital stock of $20,000.

ST. PAUL, MINN.—The Consumers' Power Company will add a $12,000 addition to its plant on Hill Street.

EAST GRAND FORKS, MINN.—The city will install 32 ornamental street lights at a probable cost of $4,000.

LEWISTOWN, MONT.—The Lewistown Electric Power Company will construct a line to Rainbow Falls.

BATTLE CREEK, NEB.—The Battle Creek Electric Light Company has been chartered with a capital stock of $25,000.

DASSEL, MINN.—A franchise for electric lights has been granted to H. B. Rutledge, of the Glencoe Electric Light Company. C.

CLARKS, NEB.—This town has voted in favor of issuing bonds to the extent of $5,000 for the establishment of an electric light plant.

COLUMBUS JUNCTION, IOWA.—An electric lighting and power franchise has been granted to E. N. Miller, and he will erect a plant. C.

COLUMBUS GROVE, O.—A new $10,000 interurban station and power house combined is to be erected at Columbus Grove this season.

NEW YORK, N. Y.—Plans have been filed for the construction of a $1,100,000 power house for the United Electric Light & Power Company.

NEWBURG, N. Y.—It is expected that the Street Committee and the Light Committee will decide to adopt a new system of lighting for Broadway.

VALLEY CITY, N. D.—E. J. Boyd, city auditor, will receive bids until May 6 for all the posts and material to be used in the proposed system of ornamental street lighting here. C.

SHELBYVILLE, IND.—City Clerk L. E. Well is asking for bids until May 7 for the construction of a pumping station and installation of machinery therein.

REMSEN, IOWA.—Remsen Electric Light & Power Company has been incorporated with a capital stock of $20,000 by J. A. Johnson, H. Johnson and George Johnson.

KANSAS CITY, MO.—Mississippi Valley Light & Power Company has been incorporated with a capital stock of $250,000 by R. G. Lafite, C. H. Smith and Otto McMahon.

PETOKA, IND.—L. C. Shepperd, superintendent of the Evansville & Southern Indiana Traction Company, has been awarded a 25-year franchise to operate a lighting plant here.

ST. LOUIS, MO.—The Missouri Transmission Company has been granted a 50-year franchise to cross Patterson and Shackelford Roads with electric wires to carry electricity.

COLLEGEVILLE, PA.—A campaign to raise $100,000 within six months has been started by Ursinus College. Out of this amount additions will be made to the heating and lighting plant.

CENTREVILLE, TENN.—John W. Frye is contemplating the erection of a hydroelectric plant in this vicinity for the development of current with which to operate the phosphate mines near Centreville.

TAYLOR, TEX.—Charles A. Zilker, of San Antonio, and associates, have purchased the property of the Citizens' Light & Power Company here and will make enlargements and improvements to the lighting system. D.

ST. LOUIS, MO.—The Ozark Water & Power Company has let the contracts for its initial hydroelectric plant on the White River, but is planning for two other power sites of 15,000 horsepower each, to be developed within two years.

NASHVILLE, TENN.—D. Y. Johnson is planning the development of electrical power at a station on Barren River, near Bowling Green, Ky. The current is to be used in the operation of large stone quarries in that district.

MARSHALLTOWN, IOWA. — The Marshalltown Light, Power and Railway Company has been sold to a party of Cedar Rapids business men, and many improvements will be made. R. S. Cook is at the head of the company.

JANESVILLE, MINN.—The Consumers' Power Company, of Chicago, has purchased the Jennison electric lighting plant. The new lines of the company will be constructed this summer and the plant in operation by September 1. C.

CINCINNATI, O.—J. C. Keifer is reported to be contracting for power sites along Duck River near Centreville, Tenn. The proposed waterpower plant will be used in the operation of a traction line through that part of Tennessee.

PORTLAND, ORE.—The Northwestern Electric Company has plans involving the expenditure of at least $10,000,000 on the development and distribution of electrical energy to be generated on the Lewis, Klickitat and White Salmon Rivers.

LOUISVILLE, KY.—The Interstate Power Company has been incorporated with a capital stock of $500,000 by J. C. Loomis, T. K. Helm and R. J. Snyder. The intention is to furnish small towns in Eastern Tennessee, in the Appalachian District, with electricity for light, heat and power.

TAUNTON, MASS.—The stockholders of the New Bedford Gas & Edison Light Company and the Fall River Electric Light Company have organized the Southern Massachusetts Power Company, a new concern which is to take over the power house of the Fall River Company and make important additions and improvements thereto.

OROVILLE, CAL.—The Feather River Power & Irrigation Company, a corporation backed by W. P. Hammon, the dredge magnate, has filed articles of incorporation with a capital stock of $10,000,000 and will build a power plant in the Feather River Canyon. The directors of the corporation are A. N. Lewis, Jr., H. J. Hill, A. L. Dahl and S. O. Vandernse.

EDINBURG, IND.—With a view to building a big power plant in Edinburg and furnishing light and power to surrounding towns the Interstate Electric Company has asked the commissioners of Bartholomew County and City Council of Columbus for a 50-year franchise to use the public highways for poles on which to string high-tension wires. S.

OGDEN, UTAH.—The Komo Light & Development Company has been incorporated with a capital stock of $50,000 by a number of Chicago capitalists, chief among whom is Elmer C. Brain. The purpose of the new company is the development of a waterpower site which will furnish Morgan City, a distance of about 25 miles from Ogden, with power for lighting purposes.

NASHVILLE, TENN.—The Tennessee Hydro-Electric Company has been incorporated in Anderson County, Tenn., with $100,000 capital stock. The incorporators are J. H. Wallace, J. R. Cox, F. M. Butler, James B. Cox and J. R. Paull. The company will develop power on either the Clinch or Powell River, and will operate in Anderson, Campbell, Union and other Tennessee counties.

VANCOUVER, WASH.—Independent Electric Company has been incorporated with a capital stock of $50,000 with Vancouver, Wash., named as the principal place of business. The incorporators are H. K. Lugger, Vancouver, and M. F. Brady, Portland. The object of the corporation is to conduct, operate and maintain the business of generating electricity for light and heating power; and to sell and operate railways and motor lines.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

CARLTON, MINN.—The Bell Telephone Company will improve its local system. C.

LARNED, KANS.—The Arkansas Valley Telephone Company will expend $10,000 in improving its lines.

SAVANNAH, MINN.—The Arago Telephone Company and the Two Inlets Company will make extensions to their lines C.

HANNAFORD, N. D.—Stock is being sold in the local telephone company, with a view to making extensions. C.

BRYAN, TEX.—The Bryan Telephone Company is preparing to modernize its plant to the extent of about $30,000.

MADELIA, MINN.—The Willow Creek Telephone Company will improve its old lines and construct a line to Vernon. C.

VIKING, MINN.—The Viking Telephone Company will commence to extend its lines as soon as the weather will permit. C.

STRATHCONA, MINN. — The Trans-Syberian Rural Telephone Company has been incorporated by C. H. Nordby and others. C.

ROCKWALL, TEX.—Mr. Thaxton, of Venus, has been granted a franchise to install and operate an independent telephone system in Rockwall.

THIEF RIVER FALLS, MINN.—It is proposed to extend the Farmers telephone line as far north as Roth, and four miles east and west. C.

COLFAX, WASH.—Whitman County Consolidated Telephone & Telegraph Company has been incorporated with a capital stock of $100,000.

SHEBOYGAN, WIS.—Six Corners Telephone Company has been incorporated with a capital of $2,000 by Nicholas Thull, George Stirdevant and Edmund Bock.

CAUSETTA, GA.—J. P. Stevens is president-general manager of a new telephone company organized to construct a telephone system to have long-distance connection with the Southern Bell Telephone & Telegraph Company.

MOOREHEAD, IOWA.—Sioux Valley Telephone Company has been incorporated with a capital stock of $400 by A. McElwain, Charles Seaton and Charles Knapp.

DEL RIO, TEX.—The Comstock & Langtry Telephone Company has been incorporated with a capital stock of $2,000 by Robert W. Prosser, L. Rust and W. H. Dodd.

GILBERT, IOWA.—The Gilbert-Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are H. Sawyer, A. Jones and P. Orning.

BLACKDUCK, MINN.—A telephone company has been organized with J. E. Dade as secretary. Lines will be constructed to Inez, Kelliher, Battle River and Quiring. C.

WILLMAR, MINN.—A. C. Bowe, of St. Paul, will begin installing the new telephone system which will operate under the name of the Willmar Home Telephone Company. C.

ROANOKE, LA.—The Rural Telephone Company has been incorporated with a capital stock of $7,000. J. M. Boose is president and F. E. McMillan secretary-treasurer of the new company.

COLFAX, WASH.—Whitman County Consolidated Telephone & Telegraph Company has been incorporated with a capital stock of 100,000. The incorporators are G. T. Smith, E. J. Byrne and others.

LEADORE, IDAHO.—An independent telephone line will be built from Tendoy to this place to accommodate farmers along the line. J. Smith, Leadore, is the promoter of the project.

KELLIHER, MINN.—A new telephone company has been formed by William Bruce and others. It is announced that a local exchange will be installed and connections made with the Bell system. C.

REDMOND, ORE.—Financial arrangements have been completed by the Deschutes Mutual Telephone Company for putting in a complete metallic line from this city to Prineville, a distance of 20 miles.

OMAHA, NEB.—The St. Clare Mutual Telephone Company has been incorporated with a capital stock of $10,000 by Orison Fields, L. E. Childs, C. F. Krenzien, Henry Martin, H. G. Eickhoff and B. F. Holton.

CHARLOTTE, N. C.—The Tulin Telephone Company has been organized with a capital stock of $10,000. The incorporators are G. J. Gouger, C. T. Allison, W. D. Goodnight, D. P. Johnson and John Oehler.

SEYMOUR, IND.—The Albering Telephone Company has been incorporated to build, equip and operate a telephone system in Jackson County. Herman Albering, Henry Duwe and John Sunderman are directors.

ELKHART, IND.—W. L. Shoots, the able manager of the Home Telephone Company of Elkhart, announces that his company has planned to spend a sum of approximately $100,000 to improve the telephone service in Elkhart County this year.

HETTINGER, N. D.—Hettinger & Cedar River Telephone Company has been incorporated with a capital stock of $10,000 to build a line from Cedar River to this place. The directors are William W. Anderson, of Hettinger, and Maurice Donnely, of Indianapolis, Ind.

CALDWELL, KANS.—The Caldwell Southeastern Telephone Company has been incorporated with a capital stock of $690. The incorporators are S. F. Niswander, G. W. Wogoman, J. R. Elmore, P. J. Bohan, Marion Fessett and J. H. Atkinson, all of Caldwell.

WAYNE, W. VA.—The Echo Telephone Company has been incorporated with a capital stock of $1,000. The incorporators are: L. F. Thompson, Theron Ball, Bol Holland and A. J. Edincott, of Genoa; John Jackson and Tolbert Smith, of Sidney; A. Booth and Bonnie Booth, of Wayne.

ROANOKE, LA.—Roanoke Farmers' Telephone Company has been incorporated with a capital stock of $7,000 for the purpose of constructing, maintaining and operating a telephone system in the town of Roanoke, and such other towns, cities and parishes as it may decide to operate in. J. M. Booze has been elected president of the company; F. F. Clayton, vice-president, and E. E. McMilan, secretary-treasurer.

ELECTRIC RAILWAYS.

(Special Correspondence.)

WEST BEND, IOWA.—It has been voted to grant a franchise to the Davenport, Iowa City & Western Traction Company.

CAMERON, TEX.—I. V. Watkins, of Dallas, is promoting the construction of an interurban electric railway between Dallas and Austin *via* Cameron. D.

TUCSON, ARIZ.—The traction company at this place has announced plans for the extension of the trolley system here which involve an expenditure of $90,000.

FORT WAYNE, IND.—The Fort Wayne & Toledo Electric Railway Company expects to build its line between Bryon, Ohio, and Fort Wayne, this summer.

SAN FRANCISCO, CAL.—New bids for the construction of the Geary Street road from Fifth Avenue to Kearney Street have been asked by the Board of Public Works.

ST. LOUIS, MO.—The St. Louis, Creve Coeur & Western Railway Company has accepted a franchise to build an interurban between St. Louis and Creve Coeur Lake. A bond issue of $5,000 has been approved.

ELKHART, IND.—The announcement is made by W. O. Gorman, superintendent of the Chicago, South Bend & Northern Indiana Railway Company, that $25,000 will be expended in improving the road this year. S.

TULARE, CAL.—David Oliver, Jr., and H. W. Coffin, both of San Francisco, have announced that they are preparing to take up the construction of the Porterville-Tulare electric railroad, which has been under discussion for five or six years.

TERRELL, TEX.—It is announced by E. T. Moore, manager of the Dallas Consolidated Railway Company, that his company has under consideration the construction of an interurban electric railway between Dallas and Terrell. The route of the proposed lines will be about 25 miles long. D.

BELLEFOURCHE, S. D.—A. A. Moodie, Bruce Sebastian, Fred S. Harris and F. E. Duba, all of Bellefourche, are the incorporators of a company formed to build an electric interurban between Bellefourche and Spearfish, a distance of 10 miles. The proposed route follows the Redwater River and Spearfish Valleys.

RICHMOND, MO.—The Richmond Commercial Club is interested in the proposed extension of the electric line of the Kansas City, Clay County & St. Joseph Electric Railway Company to this place. It is stated that a large number of farmers along the route of the proposed extension have offered the right of way through their farms.

LAFAYETE, LA.—The Louisiana Electric Railway & Power Company has been incorporated with a capital stock of $2,000,000 for the purpose of building an electric railway from New Iberia to St. Martinville, thence to Breaux Bridge, Lafayette and Abbeville and back to New Iberia. The distance covered will be about 100 miles. The main power house will be located at Lafayette. A. G. Barrow has been elected president of the company and A. J. Broussard, secretary-treasurer.

NEW INCORPORATIONS.

GALLAWAY, NEB.—The Gallaway Milling & Electric Company has been incorporated with a capital stock of $75,000.

BUFFALO, N. Y.—The McCarthy-Ford Electric Company has been incorporated with a capital stock of $10,000 by Edmond D. McCarthy, Eugene J. McCarthy and Henry R. Ford, all of Buffalo.

HENRYETTA, OKLA.—Henryetta Ice & Light Company has been incorporated with a capital stock of $10,000. The incorporators are H. H. McFann, G. W. McFann and Virgil Hicks, all of Sapulpa.

LITTLE ROCK, ARK.—The Ouachita Electric Company of Malvern has been incorporated with a capital stock of $50,000. William Kilpatrick is president; W. R. Duffie, vice-president, and Orson Kilpatrick, secretary-treasurer of the company.

NEW YORK, N. Y.—The Keyes-Lewis Company, Incorporated, has been incorporated with a capital stock of $5,000 to engage in the business of electrical contracting. The incorporators are James A. Keyes, Benjamin W. Lewis and William N. Bremer, all of New York City.

FORT WAYNE, IND.—The Indiana Electric Appliance Company has been incorporated for the purpose of carrying on the business of manufacturing electrical appliances, electric fixtures, telephones, etc. The directors are Charles F. Prange, Arthur Lepper and William L. Moellering. S.

VINCENNES, IND.—The Traction Appliance Company has filed articles of incorporation with a capital of $35,000. The object and purpose of this corporation is to manufacture, buy and sell appliances and articles of all kinds for the generation and use of electricity and other forms of motive power for propelling cars, trucks, vehicles, etc. Fred C. Morgan, Joseph J. Risch and George E. Henry are the directors.

INDIANAPOLIS, IND.—The Indianapolis Construction Company has been incorporated with a capital stock of $50,000. The object of this association is to promote, finance, construct, equip and operate in the various states, street or interurban railways and plants for the creation and distribution of electric and other heat, light and power. Cassius C. Hadley, James J. Castello and John E. Palton are the directors. S.

NEW PUBLICATIONS.

RADIOLOGY.—The proceedings of the International Congress of Radiology and Electricity, which was held at Brussels in September, 1910, have come from the press. They comprise two volumes, the first including papers dealing with the physical side of the science and the second with the biological and medical side. The two volumes together comprise over 1,000 pages. They were compiled by J. Daniel, general secretary of the International Congress.

FACTORY INSURANCE.—The Arkwright Mutual Fire Insurance Company, Boston, Mass., has celebrated its fiftieth anniversary by issuing a volume dealing with the development of the prevention idea with respect to fire loss. The members of this organization have made a long study of methods by which fire waste has been controlled, and this volume tells the story, which is of vital importance to manufacturers, engineers, architects and builders.

TERRESTRIAL MAGNETISM.—The annual report of the director of the Department of Terrestrial Magnetism of the Carnegie Institution at Washington for 1911 has been issued. It indicates by means of a map the area covered by the nonmagnetic yacht *Carnegie*, which has been making a magnetic survey of the oceans. An indication of the extent of the land observations being carried out in Africa, Asia, Europe, Australasia and South America is also given. Reprints of articles by J. A. Fleming dealing with new types of magnetometers and comparisons of standards by the Department have also been sent out.

COAL TESTS.—The Bureau of Mines has issued Bulletin No. 23 entitled "Steaming Tests of Coals and Related Investigations" by L. P. Breckenridge, Henry Kreisinger and W. T. Ray. This contains extensive results of the investigations carried on in the fuel-testing plant of the Geological Survey from 1904 to 1908. Coals from many different parts of the country were used, and the apparatus and methods used are fully discussed. The Bulletin contains 380 pages and has a comprehensive index. While the results obtained are very valuable they involve too much detail to be summarized.

COALS OF CANADA.—The first of the six volumes dealing with an investigation of the coals of Canada has been issued by the Canadian Department of Mines. This report was prepared by J. B. Porter and R. J. Durley, with several assistants. This volume consists of six parts dealing with an introduction, general description of the coal fields, collecting of samples, laboratory sampling, coal washing, and the manufacture and testing of coke. Vol. II will deal with boiler tests, gas-producer tests and the work of the chemical laboratory. This investigation is a very comprehensive one, and the first volume comprises 240 pages, with numerous illustrations and maps.

MAGNETIC OBSERVATIONS. — The Coast and Geodetic Survey, Washington, D. C., has published results of observations made at the Magnetic Observatory at Cheltenham, Md., in 1909 and 1910. Hourly values of the declination, horizontal intensity and vertical intensity, with a summary of monthly and annual means, is given. Earthquakes and magnetic storms have also been reported. The instrumental constants of the magnetographs and the absolute observations which have been taken from time to time are given. Special tables are given showing the diurnal variation of the five principal elements of the earth's magnetic field.

STARTING CURRENTS OF TRANSFORMERS.—This is the title of Bulletin No. 55, by Trygve D. Yensen, just issued by the Engineering Experiment Station of the University of Illinois. This bulletin gives the results of tests upon five commercial transformers, showing the rush of current upon closing the primary switch at various points of the impressed electromotive force wave, and with a residual magnetism of various magnitudes, with the secondary open-circuited. The phenomenon is illustrated by means of oscillograms. Three of the transformers tested are of recent manufacture, with silicon steel cores, and the other two are old types. The test shows that the starting current for the silicon-steel cores may rise to more than seven times the full-load current, while for the old types the maximum rise is not above four times the full-load current. The complete theory is given for calculating the starting currents, also for calculating a resistance or aircore inductance for limiting the starting current to safe values. In the appendix is recorded a series of tests on the permanence of the residual magnetism of transformers, and it is shown that under ordinary conditions the residual magnetism does not decrease with time, while the decrease due to severe shocks is very small. Copies may be obtained upon application to W. F. M. Goss, Urbana, Ill.

PROPOSALS.

SWITCHBOARD, ELECTRICAL SUPPLIES,ETC.—Sealed proposals, in triplicate, addressed "Proposals for Electric Lighting Supplies," will be received at the office of the Constructing Quartermaster, Fort Sheridan, Ill., until May 1 for furnishing and delivering at Fort Sheridan a switchboard, transformers, meters and a miscellaneous assortment of electrical supplies. Specifications, etc., may be obtained from the office of the Constructing Quartermaster, Fort Sheridan.

ELECTRIC PASSENGER ELEVATORS.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until May 28 for an electric passenger elevator for the post office and courthouse at Shreveport, La., and until May 29 for an electric passenger elevator for the post office at Lander, Wyo., in accordance with drawings and specifications, copies of which may be obtained from the office of the Supervising Architect.

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following items should address the Bureau of Manufacturers, Washington, D. C., and refer to the file number noted.)

NO. 8531. ELECTRIC PLANTS.—American Minister Nicolay A. Grevstad, of Uruguay, reports that anticipating prompt action by the legislature of that country regarding the establishment of a State electric monopoly, the Minister of Finance has requested the board of directors of the Electric Works of Montevideo to prepare without delay complete plans for electric plants in all the cities and important villages in the Republic. When these plans are completed bids for the construction of the plants will be solicited from manufacturers.

NO. 8631. ESTABLISHMENT OF WIRELESS - TELEGRAPH STATIONS.—An American consul has forwarded a copy of a decree, with a translation, in regard to the proposed establishment of four wireless-telegraph stations in the country in which he is located. He adds that a further description of the class of station to be installed will be forwarded when the information becomes available. Copies of the decree and translation referred to will be loaned to interested persons by the Bureau of Manufacturers upon application.

FINANCIAL NOTES.

The undertone of business affairs is strong, and while some irregularity has developed it is felt that an upward movement of business will again take place with the advance of settled, seasonable weather. Recent progress is keeping up well, and no disturbances of exceptional character is evident. Optimistic reports come in from all centers of trade activity, especially in the West and Southwest.

The National Electric Lamp Company has called for payment on May 1, at 106, at the United States Mortgage & Trust Company, New York City, all its outstanding $1,161,000 series A collateral trust bonds.

The Marconi Wireless Telegraph Company was filed with the Secretary of State of New Jersey a certificate increasing its capital stock from $1,622,500 to $10,000,000. John R. Sheffield, John L. Griggs and Kenneth K. McLaren have been elected directors of the Marconi Company, to serve five years. They fill vacancies, two of which existed for over three years. Announcement is made by the Western Union Telegraph Company that it has entered into a traffic arrangement with the Marconi Wireless Telegraph Company whereby the Western Union officers will receive and deliver marconigrams to and from Europe. The arrangement provides for the extension of the Marconi system from the Pacific Coast of the United States to Hawaii, China, Japan and the Philippines, thus giving the Western Union Company a wireless transpacific service. It is understood that the agreement extends over a period of five years.

The Guaranty Trust Company, of New York City, as trustee, announces that it will distribute in cash to the holders of Metropolitan Street Railway Company general and collateral trust mortgage five-per-cent bonds, the sum of $63.75 for each $1,000 of principal, upon presentation of said bonds for proper endorsement at its office. This action is taken pursuant to a decree of the District Court of the United States for the Southern District of New York, made April 11, 1912, in action for the foreclosure of the mortgage. The committee representing deposited five-per-cent general-mortgage bonds of the Metropolitan Street Railway Company makes a similar announcement.

Dividends.

American District Telegraph Company of New Jersey; a quarterly dividend of one per cent, payable April 29 to stock of record April 19.

East St. Louis & Suburban Company; a quarterly preferred dividend of 1.25 per cent, payable May 1 to stock of record April 17.

Kellogg Switchboard & Supply Company; a quarterly dividend of three per cent, payable May 2 to stock of record April 30.

Montreal Light, Heat & Power Company; a quarterly dividend of two per cent, payable May 15 to stock of record April 30.

Pacific Power & Light Company; a quarterly dividend of 1.75 per cent, payable May 1 to stock of record April 20.

Public Service Company of Northern Illinois, a quarterly common dividend of one per cent, and a preferred dividend of 1.5 per cent, both payable May 1 to stock of record April 24.

Tampa Electric Company; a quarterly dividend of 2.5 per cent, payable May 15 to stock of record May 1.

Toledo, Bowling Green & Southern Traction Company; a quarterly preferred dividend of 1.25 per cent, payable May 1 to stock of record April 20.

Reports of Earnings.

ELECTRIC BOND & SHARE COMPANY.

The Electric Bond & Share Company reports the following earnings:

Atlantic City Electric Co.:	1912.	1911.
12 months ended Mar. 31.		
12 months gross	$429,734	$379,063
Net	242,551	198,043
Surplus after charges	143,803	123,730
Canton Electric Co.:		
12 months gross	$320,584	$288,991
Net	162,375	154,114
Surplus after charges	106,067	103,160
The Muncie Electric Light Co.:		
12 months gross	$327,011	$288,118
Net	141,767	101,684
Surplus after charges	82,933	61,515
Rockford Electric Co.:		
12 months gross	$395,584	$367,029
Net	187,841	135,942
Surplus after charges	96,658	59,639
Scranton Electric Co.:		
12 months gross	$750,273	$697,413
Net	422,895	395,502
Surplus after charges	283,254	271,577

KINGS COUNTY ELECTRIC.

The financial statement of the Kings County Electric Light & Power Company and Edison Electric Illuminating Company of Brooklyn for the month of March shows an increase in gross operating revenue of $49,304. Following is the combined income account:

	1912.	Increase.
Gross operating revenue	$423,020	$49,303
Total operating expenses	274,422	32,585
Net operating revenues	$148,598	$16,718
Non-operating revenues	4,699	*126
	$153,297	$16,591
Bond discount written off	1,689	.....
	$151,608	$16,591
Fixed charges—Bond interest	70,546	7,500
P. & L. surplus for month	$81,061	$9,091

*Decrease.

EDISON COMPANY OF BOSTON.

The report of the Edison Electric Illuminating Company (Boston) for the month of March and nine months ended March 31 compares as follows:

	1912.	1911.
March gross	$ 505,843	$ 471,630
March net	297,533	277,287
Nine months gross	4,430,539	4,022,276
Nine months net	2,664,794	2,344,790

KEYSTONE TELEPHONE COMPANY.

The report of the Keystone Telephone Company (Philadelphia) for the month of March and three months ended March 31, compares as follows:

	1912.	1911.
March gross	$ 99,300	$ 95,862
Net after taxes	48,963	48,040
Surplus after taxes	23,964	23,689
Three months gross	294,317	286,438
Net after taxes	146,572	143,622
Surplus after charges	71,453	70,566

LAKE SHORE ELECTRIC.

The report of the Lake Shore Electric Railway System for the month of February and two months ended February 29, 1912, compares as follows:

	1912.	1911.
February gross	$ 82,118	$ 76,258
Net after taxes	25,725	28,126
Deficit after charges	9,108	6,655
Two months gross	169,271	160,828
Net after taxes	57,421	63,338
Deficit after charges	12,004	6,072

PHILADELPHIA RAPID TRANSIT.

The report of the Philadelphia Rapid Transit Company for the month of March and nine months ended March 31, 1912, compares as follows:

	1912.	1911.
March gross	$1,883,373	$1,781,679
March net	714,289	663,425
Deficit after charges	30,288	73,980
Nine months gross	16,761,662	15,831,915
Nine months net	6,446,742	6,062,331
Deficits after charges	297,922	619,435

ONTARIO POWER COMPANY.

The Ontario Power Company, of Niagara Falls, and the Ontario Transmission Company, Limited, report for the quarter ended March 31, 1912, compared as follows:

	1912.	1911.
Sale of power	$291,668	$220,057
Government rental	16,266	13,979
Gross earnings	275,442	206,078
Operating expenses	44,853	35,052
Net earnings	230,588	171,025
Other receipts	30,266	22,869
Total income	260,855	193,894
Interest charges	186,935	161,355
Surplus	73,920	32,539

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of March and three months ended March 30, 1912, compares as follows:

	1912.	1911.
March gross	$ 977,501	$ 982,270
Net after taxes	311,825	299,022
Other income	4,275	3,471
Total income	316,100	302,493
Surplus after charges	90,448	72,948
Three months gross	2,304,315	2,841,450
Net after taxes	888,412	856,821
Other income	11,011	10,890
Total income	899,423	867,710
Surplus after charges	222,573	175,916

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	April 22	April 15
Allis-Chalmers common (New York)	1⅛	1½
Allis-Chalmers preferred (New York)	3¼	4½
American Tel. & Tel. (New York)	146	145¾
Chicago Telephone certificates (Chicago)	*144	*144
Commonwealth Edison (Chicago)	145½	146½
Edison Electric Illuminating (Boston)	283¼	285
Electric Company of America (Philadelphia)	12	12⅛
Electric Storage Battery common (Philadelphia)	54⅝	54¾
Electric Storage Battery preferred (Philadelphia)	54⅝	54¾
General Electric (New York)	169	169¾
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1⅝	2
Massachusetts Electric common (Boston)	20¼	20½
Massachusetts Electric preferred (Boston)	95	95
National Carbon common (Chicago)	105	103
National Carbon preferred Chicago)	118	115
New England Telephone (Boston)	156	159½
Philadelphia Electric (Philadelphia)	18¾	18⅝
Postal Telegraph and Cables common (New York)	83½	86½
Postal Telegraph and Cables preferred (New York)	69	69¼
Western Union (New York)	84¾	82⅝
Westinghouse common (New York)	75⅝	75
Westinghouse preferred (New York)	*115	*115

*Last price quoted.

CUMBERLAND TELEPHONE.

The Cumberland Telephone & Telegraph Company has issued its report for the year ended December 31, 1911. The income account sompares as follows:

	1911.	1910.
Gross	$7,372,661	$6,897,081
Operating expenses	4,443,222	3,894,410
Net	2,929,439	3,002,671
Charges and taxes	637,208	595,402
Surplus	*2,291,231	2,407,268
Dividends	1,574,412	1,574,412
Surplus	717,819	832,856
Previous surplus	4,802,024	3,969,168
Credits adjusted		
Total surplus	5,519,843	4,802,024

*Equal to 11.65 per cent earned on $19,680,150 capital stock, compared with 12.23 per cent earned on same stock previous year.

AMERICAN DISTRICT TELEGRAPH.

The annual report of the American Telegraph Company of New Jersey for the year ended December 31, 1911, compares as follows:

	1911.	1910.
Gross earnings	$2,162,784	$3,894,578
Expenses	1,369,857	3,090,832
Net	*792,927	803,746
Dividends	398,552	398,549
Surplus	394,375	405,197

*Equal to 7.9 per cent earned on $9,965,351 capital stock.

The decrease in earnings and expenses, respectively, for the current year, compared with the year 1910, are about the same, being principally caused by the leasing of the messenger business to the Western Union Company as of January 1, 1911. Pursuant to an agreement, the latter company, after a careful investigation satisfactory to the directors of both companies, relieves this company of further responsibility in the operation of the messenger business and pays an annual rental, in monthly installments, based upon the operating returns formerly enjoyed by the American District Telegraph Company; such rental payments are subject to increase dependent upon the growth of the messenger business.

While the net earnings of the Signal Department show an increase for the year, the final balance carried to surplus is $10,822 less than 1910, due to the company's general expenses being in course of adjustment subsequent to the elimination of the messenger business.

PERSONAL MENTION.

JOSEPH McKINLEY has been elected president of the County Light Section of the National Electric Light Association in Pittsburgh, Pa.

DAVID B. RUSHMORE has an article in the May number of *Scribner's Magazine* dealing with "Water Power in Industrial Life."

WALTER B. SNOW, publicity engineer, has still further increased his office facilities by the occupancy of Rooms 421 to 426 at 170 Summer street, Boston, Mass.

FRANK DABNEY, assistant treasurer of the Seattle Electric Company, has been appointed to a similar position with the Puget Sound Traction, Light & Power Company, which took over the Seattle Electric Company on April 15.

T. S. STEVENS, signal engineer of the Atchison, Topeka & Santa Fe Railroad, presented a paper on "Signal Engineering" before the meeting of Armour Institute of Technology Branch of the American Institute of Electrical Engineers that was held in Chicago on April 24.

E. G. CONNETTE, transportation engineer of the New York Public Service Commission, has resigned and intends entering railroad service again. Mr. Connette has been with the Commission since September 1, 1909, coming to it from street-railway work in Worcester, Mass.

R. H. PINKLEY, who came to the Milwaukee Electric Railway & Light Company five years ago from the Union Electric Light & Power Company, St. Louis, Mo., has been appointed engineer of way and structures of the former company, with headquarters in Milwaukee.

CHARLES E. BROWN, secretary of the Central Electric Company, Chicago, and Miss Helen Deshler, of Columbus, Ohio, were married on Monday, April 15. On Wednesday, April 10, Mr. Brown was presented with an elegant solid silver loving cup by the employees of the Central Electric Company, every member of the organization being represented in this tribute to him. Mr. and Mrs. Brown sailed from New York on April 18 for a three-months' trip through Europe.

H. T. EDGAR has been appointed manager of the Seattle Division of the Puget Sound Traction, Light & Power Company, which is a consolidation of the Seattle Electric Company, the Seattle-Tacoma Power Company and the Pacific Coast Power Company. The Seattle Electric Company operated a street car system and a large part of the electric lighting service in Seattle. The Seattle-Tacoma Power Company also operated an electric lighting system in Seattle and furnished light to a number of suburban towns. The Pacific Coast Power Company was the owner of the White River development, the large water-power plant recently completed on the White River.

NORMAN MACBETH will resume his individual consulting illuminating-engineering practice, having resigned as illuminating engineer for the Westinghouse Electric & Manufacturing Company and the Westinghouse Lamp Company, where he recently organized an illuminating-engineering department. It will be recalled that he previously organized a similar department for the Welsbach Company, Gloucester, N. J. Mr. Macbeth has for some years been closely identified with the practical application of illuminating engineering. He will give special attention to illumination development and publicity for central stations and gas companies with particular reference to the education of salesmen, sales campaigns, and the handling of competition policies, and will maintain offices in Philadelphia and in New York City.

OBITUARY.

JOHN D. CULBERTSON, second vice-president and treasurer of the National Tube Company, Pittsburgh, Pa., died suddenly on March 13.

ITHANAR COPELAND, for the past forty-five years Troy manager of the Western Union Telegraph Company, and one of the oldest operators in its employ, died suddenly at Troy, N. Y., on April 10, aged 65 years.

JAMES W. WILSON, assistant superintendent and assistant secretary of the Missouri & Kansas Telephone Company, died on March 30. Mr. Wilson was born at Bloomfield, O., July 29, 1869. He started in the service of the Missouri & Kansas Telephone Company as messenger, afterwards becoming night operator, trouble man, foreman and manager. In 1901 he was made district manager of Oklahoma City, and later state superintendent. He was a member of the Telephone Pioneers of America.

WASHINGTON A. ROEBLING, 2nd, son of C. G. Roebling, president of the John A. Roebling's Sons Company, Trenton, N. J., is among those who went to their death when the steamship *Titanic* foundered on the morning of Monday, April 15. His conduct upon this occasion was noble and self-sacrificing to a degree, and those to whose assistance he came in the moment of peril have paid a grateful tribute to his heroism. He was about 30 years of age, unmarried, and while not closely identified with the Roebling's Sons Company, had charge of large outside interests of his father.

CHARLES A. NICHOLS died at Springfield, Mass., March 29. He was born in that city December 23, 1840. In 1879 he became one of the organizers of the Springfield Telephone Company and was its first president. This was afterwards merged with the New England Telephone Company. Mr. Nichols was in the publishing business, but was active in telephone matters and was a director in the New York & New Jersey Telephone Company, and the New York & Pennsylvania Telephone Company. He was also the first president of the United Electric Light Company, of Springfield. He was a member of the Telephone Pioneers of America.

JOHN JACOB ASTOR, who gave his life that others might live and went down to a watery grave with the steamship *Titanic* on the morning of April 15, 1912, always took a keen interest in electrical development. He found time while managing his vast estate to devote much attention to the study and practical application of mechanics, and was well informed on the state of electrical art. Colonel Astor was probably the first to use the electric storage battery in marine pleasure craft in this country, and the launches of his large yacht were equipped with this form of power. He had been a subscriber of the ELECTRICAL REVIEW since he left Harvard in 1888, and but three days before his heroic death, this office received instructions to change the REVIEW from his city home in Rhinebeck, N. Y.

DATES AHEAD.

American Institute of Electrical Engineers. Schenectady, N. Y., May 17.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., May 20-22.

Oklahoma Electric Light, Railway & Gas Association. Annual meeting, Oklahoma City, Okla., May 22-23.

Mississippi Electric Association. Fourth annual convention, Vicksburg, Miss., May 28-30.

National Electric Light Association. Annual convention, Seattle, Wash., June 10-14.

Minnesota Electrical Contractors'

Association. Annual convention, Duluth, Minn., June 16.

Michigan Section of the National Electric Light Association. Annual convention on board the *Majestic*, sailing from Port Huron, Mich., on June 21.

National District Heating Association. Annual convention, Detroit, Mich., June, 25-27.

Society for the Promotion of Engineering Education. Annual meeting, Boston, Mass., June 25-27.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25-28.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., July 16-19.

Ohio Electric Light Association. Annual convention, The Breakers, Cedar Point, O., July 17-19.

The 1912 Boston Electric Show, Mechanics' Building, Boston, Mass., September 28-October 26.

American Electric Railway Association and its five affiliated associations. Annual convention, Chicago, Ill., October 7-11.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

With the Electrical Manufacturers

The Straight Filament Lamp Company has removed its office and salesroom to 125 West Forty-second Street, New York, thus securing enlarged facilities and more convenient location.

The American Transformer Company, Newark, N. J., has issued bulletin No. 565 which fully describes its line of commercial lighting and power transformers. These are listed in two types, standard efficiency and high efficiency, the difference between these being one of performance only.

The American Engineering Company, Philadelphia, Pa., has recently supplied 35 more Taylor stokers with extension grates for the New York Edison Company's Waterside stations. This is the fifth order for Taylor stokers from this company, making a total of 115 of these stokers in the two Waterside plants.

The Roessler & Hasslacher Chemical Company, 100 Williams Street, New York City, in its monthly price list of chemicals, calls attention to its new series of Trisalyt salts for electroplating. These are triple salts that simplify the preparation of the bath and result in better and more uniform work.

The Hoskins Manufacturing Company, of Detroit, Mich., maker of Hoskins electric furnaces, pyrometers and heating appliances and International electric meters, has opened a Pittsburgh office in the Oliver Building. This office will enable the company to more adequately care for its rapidly growing business in the Pittsburgh district.

The Hanson & Van Winkle Company, 108 North Clinton Street, Chicago, manufactures among its great variety of compositions several polishing compounds, including five kinds of Tripoli compositions, Rex composition and two kinds of Vienna lime compositions for giving a brilliant finish to nickel, brass, copper and other metallic polished goods.

The V. V. Fittings Company, of New York, has opened a Chicago office and warehouse at 15 to 21 South Desplaines Street. Here are carried a complete line of all sizes and types of its fittings, thereby making it possible for the trade to obtain rush orders filled at once from stock. Robert D. Gloeckner is in charge of the Chicago office and will look after the needs of the trade throughout the Middle West.

The Wheeler Condenser & Engineering Company announces that Nathan Owitz has been appointed manager of its Cincinnati office, handling a line of high-vacuum condensing machinery, consisting of surface and jet condensers, centrifugal pumps, air pumps, cooling towers, etc. Mr. Owitz has been in the sales department in the home office of the company for the past six years and is fully acquainted with its various lines of condensing equipment.

The American Engine Company, Bound Brook, N. J., has issued a booklet entitled, "A Story Boiled Down," which covers in the form of pictures the advantages of American-Ball angle compound engines. It illustrates the angle cylinder arrangement, the efficient lubricating system, the valve gear, governor, small floor space, the absence of pounding and unbalanced forces and vibration and how angle compound engines are used in isolated plants.

The Busch—Sulzer Brothers—Diesel Engine Company, St. Louis, Mo., has issued bulletin No. 103, which is devoted to stationary types A3 and A6 Diesel oil engines. These engines are of the inclosed marine type. The bulletin explains their fundamental principles and modestly sets forth their marked advantages in fuel economy, compactness, speed regulation, simplicity of system and operation. Sectional diagrams and numerous plant views are shown and operating data given. The company has also issued a partial list of American plants using Diesel oil engines.

The H. W. Johns-Manville Company has published catalog No. 406, which is a well bound and illustrated book of 331 pages devoted to the extensive line of Noark inclosed-fuse protective devices. These fuses and their accessories are manufactured by the Johns-Pratt Company, of Hartford, Conn., the Johns-Manville organization being the sole selling agents. The catalog shows inclosed fuses for all kinds of service, together with fuse boxes, cutouts, switch boxes, conduit fittings, terminals, clips, contacts, etc. The book is well indexed for ready reference and forms a valuable addition to the commercial literature of the inclosed-fuse industry.

The Pettingill-Andrews Company, Boston, Mass., has added another touch of human interest to its monthly house organ, *Juice*, by reciting in recent issues the doing and bright philosophical sayings of the "bite." This term has been coined by the *Juice* editor to designate the youthful apprentice or raw recruit of the electrical business, to correspond with the printer's "devil" and expressman's "lumper." The April number of *Juice* also contains some interesting facts about Sprague and G. E. electric fans, Opalux and related reflectors, X-Ray indirect lighting, multigap lightning arresters, and other well-known products handled by the company.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces that among a large number of orders for substation equipment the following were secured. One from the Oakland & Antioch Railroad Company, Oakland, Cal., for a 750-kilowatt motor-generator set consisting of a 11,000-volt synchronous motor and a 1,300-volt direct-current generator. This is an unusually high voltage for a direct-current machine. The Hocking & Sunday Creek Traction Company, of Nelsonville, O., has ordered a 400-kilowatt, 60-cycle rotary converter set consisting of two converters in series, each being 600-volt machines. This gives a 1,200-volt system for direct-current interurban-railway use.

The General Electric Company, Schenectady, N. Y., has just issued an elaborate bulletin (No. 4,923) devoted tc the electrical equipment of iron and steel mills. This 72-page bulletin has an attractive cover, is copiously and well illustrated and should be of great interest to everyone connected with the steel industry. Among the subjects with which the bulletin deals are generating and transforming apparatus for steel-mill service, electrical distribution of power for steel plants, small mill-type motors for alternating-current and direct-current service, large alternating-current and direct-current motors for rolling-mill service, control equipments for steel mills, synchronous condensers for improvement of power-factor, and electric lighting of steel plants. The illustrations are from the most modern steel plants and give an excellent idea of the great extent of electric power application in steel mills.

Record of Electrical Patents.

Issued by the United States Patent Office, April 16, 1912.

1,023,121. Electric Lighting System. C. E. Bonine, Philadelphia, Pa. A compound generator on an automobile has an automatic regulator governing its connection to a storage battery for charging.

1,023,122. Electric Lighting and Engine-Starting System. C. E. Bonine, Philadelphia, Pa. Includes a generator, battery and lighting set as above, but a throw-over switch is arranged to change the generator to a motor for starting the engine.

1,023,123. Fire Alarm. C. G. Carlson, Chicago, Ill. An inflammable cord holds an electric alarm circuit open.

1,023,127. Electric Chain-Welding Machine. M. B. Ryan, assignor to Automatic Chain Co., Buffalo, N. Y. Jaws press each link against a pair of stationary electrodes.

1,023,127. Electric Chain-Welding chine. M. B. Ryan, assignor to McKinnon Chain Co., New York. Includes a gravity-actuated transformer carrying electrodes, and an automatically rotatable turret carrying grippers for temporarily holding an article to be welded.

1,023,129. Chain-Welding Machine. M. B. Ryan, assignor to McKinnon Chain Co. Has two sets of electrodes, the current being applied to each pair alternately.

1,023,130. Electric Welding Machine. M. B. Ryan, assignor to McKinnon Chain Co. Includes presses for removing the bur from the welded joint.

1,023,134. Alternating-Current Motor-Controlling Apparatus. J. Dillon, assignor to Otis Elevator Co., Jersey City, N. J. Includes a set of relays for controlling the starting resistances.

1,023,135. High-Frequency Apparatus. W. Dubilier, Seattle, Wash. An oscillation transformer for wireless telephony.

1,023,161. Flash-Light Apparatus. I. G. McColl, New York, N. Y. Includes an electric circuit for igniting the powder in a series of smoke bags.

1,023,166. Gauge. H. Oenning, Chicago, Ill. An alarm circuit is connected with a pressure gauge.

1,023,178. Battery-Holder. H. A. Stevens, Malden, Mass. Bands of strap iron embrace the bottom and sides of the cells and are connected to a suspension rod.

1,023,180. Ignition Apparatus for Hydrocarbon Engines. M. Tibbetts, assignor to Packard Motor Car Co., Detroit, Mich. The wires leading to the different spark plugs are supported over each other.

1,023,183. Circuit-Closer. S. P. Watson, Brooklyn, N. Y. A three-armed lever arranged as a double-throw spring knife switch.

1,023,185. Telephone-Exchange System. H. G. Webster, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Includes a differential signal-controlling relay.

1,023,200. Electrical Impulse-Transmitting Device. J. Erickson, assignor to First Trust & Savings Bank, Chicago, Ill. A subscriber's calling device for an automatic telephone has an apertured calling dial rotatable in one direction only.

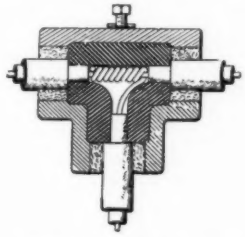
1,023,215. Electromagnetic Sounding Apparatus. C. W. McGonigle, Algona, Wash., assignor of one-half to George E. Miller. An electromagnet vibrates a large diaphragm.

1,023,220. Junction Box. T. E. Murray, New York, N. Y. A branch box for high-tension lead-covered cables has a heavy insulating casing fitting close about the insulated conductors, a packing of lead floss about the ends of the lead sheaths, and an iron casing outside.

1,023,224. Door Switch. J. G. Peterson, assignor to Arrow Electric Co., Hartford, Conn. Has one spring for the switch mechanism and a separate stiffer spring for the push-button.

1,023,246. Floor Box. J. Fountain, Jr., Elizabeth, N. J., and B. Jones, Jr., New York, N. Y.; said Jones assignor to said Fountain. Has a double cover with means for supporting an electric fixture stand.

1,023,256. Composite Electric System. A. D. T. Libby, assignor to Dean Electric Co., Elyria, O. A combined police telephone and lamp-signaling system.



1,023,220.—Junction Box.

1,023,261. Pole-Changer. R. H. Manson, assignor to Dean Electric Co. An electromagnetically vibrating device for telephone ringing.

1,023,264. Switch. J. F. McElroy, assignor to Consolidated Car Heating Co., A cutout switch controlled by a pair of differential series coils.

1,023,270. Spiral Coil for Fastening Wire Terminals. P. P. Nungesser, assignor to Nungesser Electric Battery Co., Cleveland, O. Consists of a coil of flat spring metal having exposed terminals and wire-engaging portions at two places in the edge of each convolution.

1,023,271. Fastening Device for Wire Terminals. P. P. Nungesser, assignor to Nungesser Electric Battery Co. Formed of spring sheet metal bent into a number of coils having holes approximately diametrically opposite in each coil.

1,023,286. Vapor Electric Apparatus. W. R. Whitney, assignor to General Electric Co. A mercury-vapor rectifier has in it a platform to intercept the flow of mercury from its normal position.

1,023,289. Series Lighting System. L. Arons and M. Fuss, assignors to General Electric Co. A set of mercury-vapor lamps connected in series has automatic means for starting one after another.

1,023,290. Reduction of Oxides. W. C. Arsem, assignor to General Electric Co. Consists in placing tungstic acid in a pervious receptacle, packing the receptacle in carbon, and heating to cause reduction of the tungstic acid by carbon monoxide diffusing into the crucible.

1,023,293. Arc Lamp. G. Baldauf and E. Presser, assignors to General Electric Co. Guide bars and carbon holders for a converging-electrode lamp.

1,023,295. Manufacture of Metallic Filaments for Incandescent Electric Lamps. H. Bresler, assignor to General Electric Co. A plastic paste for filament manufacture comprising finely divided tungsten held in a binder of ammonium viscose.

1,023,299. Method of Making Meter Jewels. H. R. Connell, assignor to General Electric Co. Consists in fusing a dense homogeneous tungsten bead in the presence of carbon vapor while in a mold.

1,023,304. Electrical Measuring Instrument. A. L. R. Ellis, assignor to General Electric Co. Has a modified D'Arsonval construction.

1,023,305. Filament Apparatus. S. Ferguson, assignor to General Electric Co. The filament body is heated by passing current through it to vaporize the binder and gradually contract the tungsten and impose a load thereon.

1,023,307. Incandescent Lamp. L. Glaser, assignor to General Electric Co. A filament anchor comprising a hook rigidly mounted and a movable part engaging with the filament and spirally wound about the hook.

1,023,309. Electrical Resistance Furnace. H. Helberger, Munich, Germany. Has a cylindrical heater with annular circuit terminals.

1,023,310. Oil Switch. E. M. Hewlett, assignor to General Electric Co. Has a special partition to direct the oil against the arc.

1,023,315. Metal Filament. M. A. Hunter, assignor to General Electric Co. The process consists in glowing a tantalum filament in an atmosphere of nitrogen to increase the specific resistance of the filament.

1,023,316. Apparatus for Drawing Wires. E. Hurwitz, assignor to General Electric Co. The drawing-machine motor is controlled in unison with a circuit sending heating current through the wire as it passes the die.

1,023,326. Electric Cutout. T. E. Murray, New York, N. Y. The fuses are mounted on a cover plate which fits over the base blocks.

1,023,338. Trolley Wheel. W. H. Schultze, Houston, Tex. Has guard jaws embracing the wheel.

1,023,348. Operating Mechanism for Magneto-Generators. A. Zahringer, assignor to Firm of Robert Bosch, Stuttgart, Germany. The armature has an actuating lever carrying a cam.

1,023,357. Mounting Filaments. E. P. Beckwith, assignor to General Electric Company. The plastic filament is mounted on the supports, treated to render it non-ductile, and then the whole inserted in the bulb.

1,023,371. Electric Furnace. C. T. Fuller, assignor to General Electric Co. Includes a carbonaceous resistance tube, means for supplying hydrogen thereto, and a charge-protecting boat partly of rutile inserted in the tube.

1,023,377. Automatic Sectionalizing Device. L. A. Hawkins, assignor to General Electric Co. An automatic switch joining adjacent transmission-line sections is controlled by step-down transformers.

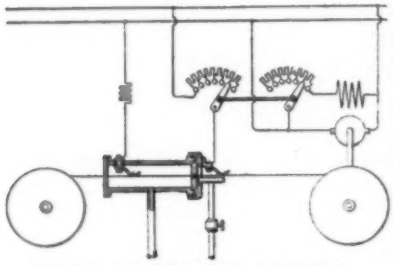
1,023,410. Electric Signal Switch. C. Beck and A. Beck, assignors to Beck Automatic Electrical Safety & Signal Switch Co., St. Louis, Mo. An electromagnet moves an oscillating switch arm.

1,023,424. Arc Lamp. P. Hanisch and J. Rosemeyer, Cologne, Germany. Includes two electromagnets for feeding and striking the arc between converging flaming electrodes.

1,023,434. Detachable Chain Guide for Lamp Sockets. A. S. Lyhne, Bridgeport, Conn. The flaring guide fits in a slot in the socket shell.

1,023,440. Railway Signal. I. W. Pierce, New York, N. Y. A shoe carried by the car engages signal circuit-controlling levers.

1,023,449. Portable - Incandescent-



1,023,316.—Wire-Drawing Apparatus.

Lamp Handle. L. T. Washington, Mount Rainier, D. C. The handle has a socket at its end.

1,023,460. Outlet Box. Edward J. Dustman, New York, N. Y. For use with combination fixtures. Has grooves for the electric wires and a central opening for a gas pipe.

1,023,475. Electric Heater. C. P. Madsen, assignor to Pelouze Manufacturing Co., Chicago, Ill. The resistance strip is bent back and forth and held stretched during operation.

1,023,480. Telephone-Exchange System. E. E. Clement, Washington, D. C. The automanual system in which each subscriber has ordinary equipment and operators at the exchange control the automatic switches.

1,023,482. Party-Line Selective Signaling System. C. E. Scribner, assignor to Western Electric Co., Chicago, Ill. Pulsating current is supplied to biased ringers connected with each limb of the line.

1,023,485. Illuminant for Electrical Incandescent Lamps. O. M. Thowless, Newark, N. J. A heating body composed essentially of a carbide of silicon.

1,023,490. Battery-Current Limiting Device. H. M. Beck and C. Ambruster, Chicago, Ill. The booster field is controlled by a polarized electromagnetic device adapted to weaken it as the battery charge proceeds.

1,023,491. Electric Motor-Starting Device. C. J. Anderson, Chicago, Ill. A multiple-switch starter in which an electromagnet operates a roller that bears against cams on the successive switches to close them.

1,023,493. Spark Plug. F. Bartl, New York, N. Y. The outer electrode shell has a central constriction.

1,023,498. Means for Charging Storage-Battery Cells. C. W. Bell, assignor to Electric Storage Battery Co., Philadelphia, Pa. Weak cells are brought up by putting an electrolytic valve in series on one side and another in shunt around this and the weak cells, thus permitting the latter to be charged but not discharged.

1,023,500. System of Electrical Distribution. L. E. Bogen, assignor to Allis-Chalmers Co., Milwaukee, Wis. Two rotary converters are in parallel on the D. C. side, but have their A. C. sides fed from different windings of the main generator.

1,023,503. High-Potential Relay. H. W. Cheney, assignor to Allis-Chalmers Co. Governs a low-voltage switch by movement of its core.

1,023,511. Dynamo-Electric Machine. B. Frankenfield, assignor to Allis-Chalmers Co. Has a special interconnection of the commutating poles and the series windings on the main poles.

1,023,543. Resistance Element. J. G. Zimmerman, assignor to Allis-Chalmers Co. A compressible resistance set has carbon granules in a cylinder with a compression head moving against an internal spring.

1,023,545. Electrolytic Process. H. H. Bates and F. Adam, Joliet, Ill. A continuous stream of liquid is passed through a regulated preheater and then through the electrolytic cell.

1,023,552. Dual Ignition System. R. H. Cunningham, New York, N. Y. A make-and-break magneto and battery system.

1,023,557. Multiple Telephone-Transmitter. C. E. Egner, Stockholm, and J. G. Holstrom, Saltsjo-Storangen, Sweden. Has a number of transmitter cells.

1,023,597. Trolley Retriever and Catcher. R. Shields, assignor to Frank Ridlon Co., Boston, Mass. The retriever has a rope-winding device in a circular casing.

1,023,599. Electric Trap. Istvan Takacs, Barberton, O. A rat trap with two eccentric overlapping electrode loops separated from each other.

1,023,602. Electric Steam-Heating Apparatus. J. G. Wallmann, assignor to Wallmann Electric Heater Co., San Francisco, Cal. The boiler has a heating element mounted on a plug.

1,023,606. Electric Rat Trap. W. Zaniewski, Boston, Mass. A box on top of a tank has tiltable cover plates and electrode plates beneath them.

1,023,649. Attachment for Electroliers. F. I. Hollingsworth, Denver, Colo. The canopy is specially arranged to have several chain pendants at its outer edge.

1,023,684. Electric Clock-Winding Mechanism. George H. Rupley, assignor to F. J. Seabolt and C. Hall, Schenectady, N. Y., and E. C. Pickford, Washington, D. C. An electric motor raises the weight periodically.

1,023,691. Electric Switch. G. H. Taylor, Helena, Mont. Is mounted on, and actuated by movement of, a dental bracket.

1,023,743. Electric Signaling Device. A. Lungen, assignor to Edwards & Co., Inc., New York, N. Y. An electromagnet vibrates a spring that strikes the diaphragm in a horn.

1,023,754. Electric Cooking Utensil. L. F. Parkhurst and H. G. Weeks, assignors to Diamond Electric Co., Binghamton, N. Y. A toaster with several heating units mounted on a skeleton support.

1,023,755. Electric Heating Apparatus. L. F. Parkhurst, assignor to Diamond Electric Co. Has several thermostatically controlled heating units in the walls of the vessel and a separate heating unit for its throat.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired April 23, 1912:

537,826. Spark Arrester and Conductor. C. P. Johnson, Thurman, Kans.

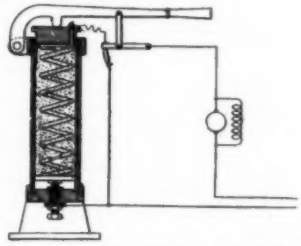
537,829. Electric Alarm Clock. H. W. Knapp and L. E. Gerrety, St. Paul, Minn.

537,855 and 537,856. Electrical Appliance for Elevators. J. H. Roberts, Grand Rapids, Mich.

537,857. Electric Motor Car. W. Robinson, Boston, Mass.

537,860. Electric Guest Call. F. O. Smith, La Crosse, Wis.

537,876. Rheostat. G. H. Whittingham, Baltimore, Md.



1,023,543.—Compressible Resistance.

537,907. Rosette or Ceiling Cutout. E. A. Snow, Syracuse, N. Y.

537,920. Coupling for Electrical Connections. J. M. Faulkner, Philadelphia, Pa.

537,932. Method of and Apparatus for Protecting Electric Circuits. J. M. Oram, Dallas, Tex.

537,967. Telephone System. W. Coonan, Jersey City, N. J.

537,989. Storage Battery. M. Moskowitz, Newark, N. J.

537,994. Controlling Mechanism for Electric Motors. C. H. Richardson, Philadelphia, Pa.

538,005. Electric Railway. C. C. G. Wolpers, Brooklyn, N. Y.

538,023. Electric Arc Lamp. F. M. Lewis, London, Eng.

538,024. Electric Brake. E. D. Lewis, Savona, N. Y.

538,083. Separable Terminal for Conductors. D. N. Osyor, Columbus, O.

538,090. Electric Cutout. H. A. Wagner and F. Schwedtmann, St. Louis, Mo.

538,097. Commutator Brush. L. Bordeaux, Paris, France.

538,104. Electric Motor for Railway Cars. C. E. Emery, Brooklyn, N. Y.

538,127. Electric Door Opener. J. Schneider, Long Island City, N. Y.

538,132. Electrical Igniting Device for Gas Engines. A. J. Signor, Elkhart, Ind.

538,136. Working of Railway Points and Signals by Electricity. I. A. Timmis, London, Eng.

538,158. Electric Railway System. J. M Faulkner, Philadelphia, Pa.